CORNELL UNIVERSITY ANNOUNCEMENTS

SEPTEMBER 28, 1962

GRADUATE SCHOOL 1963—1964

CALENDAR (Tentative)

FALL TERM

	1962–1963	1963–1964
Registration (new students, first day)	Sept. 17–18	Sept. 23–24
Instruction begins at 1 p.m.	Sept. 19	Sept. 25
Language examinations, French, German, and Russian	Sept. 20	Sept. 26
Last day for filing statement-of-courses form and change-of-committee form and for new students to file candidacy forms	Oct. 2	Oct. 8
Last day for taking qualifying and language examinations other than French, German, or Russian in order to have them considered as of the beginning of the term	Nov. 1	Nov. 1
Thanksgiving recess: Instruction ends at 12:50 p.m.	Nov. 21	Nov. 27
Instruction resumes at 8 a.m.	Nov. 26	Dec. 2
Last day for change-of-course registration	Nov. 24	Nov. 23
Christmas recess: Instruction ends at 10:00 p.m. in 1962, 12:50 p.m. in 1963	Dec. 19	Dec. 21
Instruction resumes at 8 a.m.	Jan. 3	Jan. 6
Last day for completing all requirements for February degrees	Jan. 11	Jan. 10
Term ends	Jan. 30	Feb. 5

SPRING TERM

Registration for students in residence	Jan. 21	Jan. 27
Registration for new and readmitted students	Feb. 2	Feb. 8
Instruction begins at 8 a.m.	Feb. 4	Feb. 10
Language examinations, French, German, and Russian	Feb. 5	Feb. 11
Last day for filing statement-of-courses form and change-of-committee form and for new students to file candidacy forms	Feb. 15	Feb. 21
Last day for filing fellowship and scholarship applications for the following year	Feb. 1	Feb. 1
Last day for taking qualifying and language examinations other than French, German, and Russian to have them considered as of the beginning of the term	Mar. 1	Mar. 1
Spring recess: Instruction ends at 12:50 p.m.	Mar. 23	Mar. 28
Instruction resumes at 8 a.m.	Apr. 1	Apr. 6
Last day for change-of-course registration	Apr. 20	Apr. 18
Last day for completing all requirements for June degrees	May 24	May 22
Term ends	June 4	June 9
Commencement (conferral date for June degrees)	June 10	June 15

SUMMER

Summer Research period begins	June 5	June 10
Registration for Summer School	June 26	July 1
Last day for filing statement-of-courses form and change-of-committee form and for new students to file candidacy forms	July 19	July 24
Summer School ends	Aug. 9	Aug. 14
Last day for completing all requirements for September degrees	Aug. 30	Aug. 28
Summer Research period ends	Sept. 21	Sept. 19

CORNELL UNIVERSITY ANNOUNCEMENTS

Supplement to Volume 54, Number 7, September 28, 1962

THE GRADUATE SCHOOL

The University Board of Trustees has found it necessary to increase tuition and fees, effective June 5, 1963. The tuition and General Fee for each term in the Graduate School will be as shown below.

When the major field of study is in a state-supported division (Agriculture, Home Economics, Industrial and Labor Relations, or Veterinary) or in the Graduate School of Nutrition:

Tuition, $200.00; General Fee, $187.50; total each term, $387.50.

When the major field of study is in an endowed division:

Tuition, $685.00; General Fee, $165.00; total each term, $850.00.

CORNELL UNIVERSITY

GRADUATE SCHOOL

1963-1964

CORNELL UNIVERSITY ANNOUNCEMENTS. Volume 54. Number 7. September 28, 1962. Published twenty times a year: twice in March, April, May, June, July, August, October, December; three times in September; once in November; no issues in January or February. Published by Cornell University at Edmund Ezra Day Hall, 18 East Avenue, Ithaca, New York. Second-class postage paid at Ithaca, New York.

CONTENTS

ADMINISTRATION

DEANE W. MALOTT, A.B., M.B.A., LL.D., D.C.S., *President of the University*
DAMON BOYNTON, B.S., PH.D., *Dean of the Graduate School*
FREDERICK S. ERDMAN, B.S., B.S. in M.E., M.M.E., PH.D., *Associate Dean of the Graduate School*
JOHN E. DEITRICK, B.S., M.D., *Associate Dean of the Graduate School of Medical Sciences*
CARROLL C. ARNOLD, B.A., M.A., PH.D., *Secretary of the Graduate Faculty*

GENERAL COMMITTEE

PROFESSOR J. K. LOOSLI, *at large, term expires 1963*
PROFESSOR DOUGLAS F. DOWD, *at large, 1963*
PROFESSOR W. D. COOKE, *at large, 1965*
PROFESSOR J. M. ECHOLS, *at large, 1965*
PROFESSOR GORDON M. KIRKWOOD *(Humanities), 1963*
PROFESSOR ——— *(Humanities), 1965*
PROFESSOR KENNETH L. ROBINSON *(Social Sciences), 1963*
PROFESSOR W. W. LAMBERT *(Social Sciences), 1965*
PROFESSOR R. P. MURPHY *(Biological Sciences), 1963*
PROFESSOR ——— *(Biological Sciences), 1965*
PROFESSOR KENNETH GREISEN *(Physical Sciences), 1963*
PROFESSOR M. H. COHEN *(Physical Sciences), 1965*

THE SECRETARY OF THE GRADUATE FACULTY, *ex officio*
THE ASSOCIATE DEAN, *ex officio*
THE DEAN, CHAIRMAN *ex officio*

The main business office of the Graduate School is in Day Hall, Room 125. The office of the Dean is in Sage Graduate Center, Room 106. Office hours are 8:30 a.m. to 4:30 p.m. Monday through Friday, and 8:30 a.m. to noon on Saturday (except during the summer).

THE GRADUATE SCHOOL

THE GRADUATE SCHOOL of Cornell University has jurisdiction over "all graduate work and any degree beyond the first degrees given by any college or school." * It offers its students facilities for advanced study and research and assists them in obtaining a comprehensive view of a field of knowledge, together with the training required for independent investigation. It encourages them to associate freely with mature scholars who will give them the aid and direction they need. It expects to attain its end less through imposing an elaborate system of requirements than through developing a sense of responsibility for the advancement and wise application of knowledge.

The Graduate School recognizes a difference in administration and purpose between two types of advanced degrees: *General* and *Professional.*

GENERAL DEGREES

MASTER OF ARTS, MASTER OF SCIENCE, DOCTOR OF PHILOSOPHY

The Graduate School itself, and not a college or departmental group, administers and confers general degrees.† It imposes few requirements, permits great latitude to the individual in choice of studies, and expects each candidate to utilize all resources of the University relevant to his work. It emphasizes an essentially scientific training, a pursuit of truth as an end in itself rather than as a by-product of professional attainment.

The following sections relate less to the procedures upon which the Graduate School relies to secure these results ‡ than to practical situations the student may encounter in beginning and carrying on his work.

ADMISSION

To be admitted, an applicant (1) must hold a Bachelor's degree from a college or university of recognized standing, or must have done work equivalent to that required for such a degree; (2) must have had adequate preparation in the chosen field of instruction; and (3) as judged by his previous scholastic record or other achievements, must show promise of doing well in advanced study and research. However, despite very good academic records, some applicants may be refused admission because of the limited staff and facilities in some fields.

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* This Announcement does not describe instruction in the Graduate School of Medical Sciences; inquirers interested in the instructional programs of that School should address the Associate Dean of the Graduate School, Cornell University Medical College, 1300 York Avenue, New York 21, N.Y., or write to that office for the *Announcement of the Graduate School of Medical Sciences.*

† For professional degrees, see p. 11.

‡ These matters are described in detail in a *Code of Legislation,* copies of which may be obtained from the Graduate School Office by enrolled students and which are available for consultation in academic and administrative offices of the University.

Hence, assurance cannot be given that an application for the fall term received after February 1, or for the Summer Session after May 1, will receive the same consideration it might have been accorded at an earlier date.

Inquiries and requests for application forms should be addressed to the Graduate School Office, 125 Day Hall, Cornell University, Ithaca, New York. Since admission acceptance will be delayed until all supporting credentials have been received, recommendations and transcripts should follow the application as speedily as possible. *A fee of $10 must accompany the application. Otherwise, the application will not be processed.*

All applicants who can do so are urged to include with their credentials scores of Graduate Record Examination Aptitude (Verbal and Quantitative) Tests taken recently by them. These examinations are administered five times a year at many centers throughout the United States and Canada, and in many foreign countries. For information about them, address the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey. The following Fields of the Graduate School *require* the scores of Graduate Record Examination Aptitude Tests as a basis for admission: Anthropology, Business and Public Administration, Classics, Child Development and Family Relationships, Economics,* English,* General Biology,* General Linguistics, Geology and Geography, Government,* History, Industrial and Labor Relations, Music, Psychology,* Sociology, Speech and Drama, and Zoology.*

Applicants to the Veterinary Field from countries other than the United States and Canada are requested to include in their credentials the results of the Graduate Record Examination (Aptitude Test) except in cases where this examination is not given in reasonable proximity to the student's home. Where the Graduate Record Examination is not available, the student is requested to submit the results of the College Entrance Board Examinations (Scholastic Aptitude Tests) in their stead.

If for satisfactory reasons a person cannot take the examination before he wishes his application acted upon, the Graduate School may act provisionally, pending submission of scores at a later date.

Uncompleted files will be destroyed after one year; applications refused or temporarily withdrawn will be destroyed after three years unless the sender requests reconsideration.

PROVISIONAL CANDIDATES

If for some reason applicants are not considered to be completely qualified for candidacy, they may be admitted as provisional candidates. Usually they may register for only one term in this status; but upon recommendation of their advisers and with the approval of the Graduate School, they may reregister once. If later admitted to candidacy, they may petition for transfer of not more than one residence unit, provided they can submit convincing evidence that their work has been of the same quantity and quality as would have been required of candidates.

Since it is often difficult to evaluate the academic records of students from other countries, it is the policy of the Graduate School to admit most foreign students as provisional candidates.

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* The six starred Fields require scores of both the Aptitude Test and the pertinent advanced test.

NONCANDIDATES

When staff and facilities are available, the Graduate School will admit some applicants as noncandidates who wish advanced training but do not intend to take another degree. As a rule, they may register as noncandidates for only two terms.

VISITING FELLOWS

Whenever possible, the faculty welcomes mature scholars who wish to use the facilities of the University to prosecute investigations or to work with the faculty in the advancement of knowledge. A scientist or scholar who wishes to work on the campus may, upon recommendation of the head of the department in which he wishes to work and endorsement of the college dean over that department, be given the title of Visiting Fellow by the President, providing he has no formal duties to perform and is paid no salary by the University. Visiting Fellows are exempt from tuition and University fees, but they will be expected to register with the Graduate School Office within two weeks after arrival. Research performed or courses attended as a Visiting Fellow are not credited toward advanced degrees, nor is any record kept of such work.

CHANGE OF STATUS

A student who wishes to change his status from provisional candidacy to regular candidacy or from one degree or field to another, or who, after receiving the Master's degree, wishes to undertake candidacy for the doctorate, must submit a request in writing to the Dean of the Graduate School, asking for transfer to the new status. Reasons for the change in status should be given.

DUPLICATION OF DEGREES

The Graduate faculty receives occasional inquiries regarding candidacy for a second Master's or a second Doctor's degree. The Graduate faculty does not grant a second general degree at the same level except under unusual circumstances. The holder of an advanced degree should consider applying as a noncandidate (see above).

REGISTRATION

All graduate students in residence and using facilities of the University, whether or not they are taking courses, must register with the Graduate School and with the Registrar at the specified times, unless granted a leave of absence by the Dean of the Graduate School. Before the fall term, the Registrar notifies each student of an hour at which he is to report, and anyone who does not have notification at least a week before registration day should communicate with the Graduate School. For the spring term, the Registrar notifies only *readmitted* and *new* students; all others should claim registration permit cards at Barton Hall at a time announced in college offices and the *Cornell Daily Sun*.

When registering, the student should report to the table of the Graduate School, not to that of a college. He must register in person, not by proxy. If he cannot appear at the appointed hour, he must report to the Graduate School

Office as soon as possible, bringing a written explanation endorsed by his adviser or chairman. A fee of $5 is required for late registration by matriculated students, not as a fine, but as a payment of additional cost to the University for registering a student out of phase.

MAJOR AND MINOR SUBJECTS

The studies of candidates for the degrees of Master of Arts and Master of Science must be in one major and one minor subject; those for the doctorate, in one major and two minor subjects. The possible subjects are listed under the separate Fields of Instruction.

The standards of attainment for each subject are fixed by the member of the faculty who represents the subject on the Special Committee; he requires whatever in his judgment is necessary for proper training, including attendance in courses and seminars, as well as supervised or independent study. Since he will adjust the work to the candidate's preparation and interests, programs of persons registered in the same subject may differ greatly.

Within two weeks of first registration (one week for Summer School) and after consultation with members of the faculty, a candidate must notify the Graduate School of his selection of major and minor subjects. Subsequently, opportunity is provided for changes in major or minor subjects, when such changes appear educationally feasible and desirable. Such a change must be reported immediately to the Graduate School Office on the proper forms. However, the change can be completed only after the student has received assurance that faculty members representing the new subjects will undertake to direct his study in these subjects.

SPECIAL COMMITTEES

Every candidate works under the direction of a Special Committee. Its members may be professors, associate professors, assistant professors, or instructors who hold the Doctor's degree and who have as their primary work teaching and research on the Ithaca campus. Other persons holding professional appointments may also be eligible to serve as members of Special Committees provided their names appear on the Roster of the Graduate Faculty. A copy of the Roster may be consulted in the Graduate School Office. The Chairman is the representative of the major subject.

The Chairman and the other members express their willingness to serve by signing the record of major and minor subjects, which the candidate files at the Graduate School. Subsequent changes in the membership of the Committee must be approved by all members of the newly constituted Special Committee and by the Dean.

The members of the Special Committee decide upon the candidate's program of study and research and whether he is making satisfactory progress, and they recommend the award of the degree. They conduct and report on all examinations required for the degree and approve and accept the thesis. The Committee and the candidate constitute an independent working unit. However, all members of the Graduate faculty are free to participate in the scheduled examinations and to review the theses of candidates for degrees.

The candidate himself must accept full responsibility for meeting the requirements of the Graduate School enumerated below.

RESIDENCE

The Graduate faculty regards study in residence as essential. For although a person working off-campus may attain proficiency in a technique or even in a field of knowledge, he may fail in other ways to become such a representative as the School hopes to produce. In addition to contact with the libraries and physical facilities of the University, he needs the acquaintance, company, aid, and stimulus of others engaged in work like his own; he should form the habit of attending lectures and recitals and the meetings of groups in whose activities he takes interest.

The faculty, therefore, requires that the record of each candidate for a Master's degree show two units of residence; that of each candidate for the doctorate, six units. Full-time study for one semester with satisfactory accomplishment constitutes one residence unit. In general, the time required for completion of work in candidacy for a degree exceeds these minimum requirements. Residence credit is recommended by the candidate's Special Committee in accordance with the formula for residence credit eligibility stated below, when in its opinion the student has satisfactorily completed a term's work. *A candidate for the doctorate must complete two of the last four units in successive terms of study on the Cornell campus, earning at least one-half a residence unit each term.*

Beginning in the academic year 1962–1963, the following legislation, with respect to eligibility of part-time employees for residence units, will be in effect:

Employment	Residence Units Allowable per Semester		
(Total clock hrs. per week)	*Contributory in the major field of study and on campus*	*Noncontributory but on campus*	*Off campus*
0–10 hours	1 unit	1 unit	1 unit
11–20 hours	1 unit	¾ unit	¾ unit
21–30 hours	¾ unit	½ unit	*(See paragraph below)*

If the employment is more than 20 clock-hours per week and is off campus, or if it is more than 30 clock-hours per week under any circumstances, a maximum of two-fifths of a residence unit per semester may be earned through registration in the Division of Extramural Courses, *but this will be permitted only on the basis of petition approved prior to the time that the work is undertaken.* For the degrees of M.A. or M.S. a maximum of one unit, and for the degree of Ph.D. a maximum of two units, of residence may be earned in this way.

As a general rule, the Graduate School will not permit anyone to receive credit for more than two residence units in any period of twelve consecutive months.

TRANSFER OF RESIDENCE

Candidates for the Master's degree may not count study in other graduate schools as part of their residence, but are allowed to claim credit for two-fifths of a unit for previous work in the Cornell Summer Session. Candidates for the doctorate may be permitted to count study elsewhere for the Master's degree as

equivalent to two residence units; and those who have received training of an exceptional quality and amount may petition for more. But no commitment regarding this may be made until after the student has entered into residence, and his Special Committee has had further opportunity to judge his accomplishments. The residence transferred cannot exceed that which would have been earned under similar circumstances at Cornell. Credits secured during study as an undergraduate or as a Special Student, even for work in courses designed primarily or wholly for graduate students, will not be allowed.

SUMMER RESEARCH

Although a maximum of two residence units may be earned in a period of twelve consecutive months beginning with the first semester of the academic year, it is expected that most graduate students will continue their studies during the summer period. Provision is made for those who have earned one or two units of residence in the previous academic year to make use of the facilities of the University during the subsequent summer. Such students also have access to the regular services of the University Clinic and Infirmary without additional charge. For details see p. 15 under College and University Fee.

A candidate who has been in residence at Cornell during two regular semesters and who is eligible for summer residence units may, on recommendation of his Special Committee and with the approval of the Dean at least one week in advance, be permitted to register for an eight-week period of Summer Research under the personal direction of a member of the Graduate faculty.

One-half residence unit may be granted upon certification of satisfactory completion of full-time study during the eight weeks for which the candidate has registered. Assistants under contract during the summer or during the Summer School may be permitted to study for twelve weeks for one-half of a residence unit. Those employed part-time in the summer, other than on twenty-hour assistantships, should inquire at the Graduate School Office as to their residence eligibility during the summer. A maximum of two units may be earned in Summer Research, and no more than two residence units may be earned in any period of twelve consecutive months. The *Code of Legislation* should be consulted for further details.

Applications for Summer Research registration are obtainable at the Graduate School Office. The Summer Research period extends from the end of the spring term to the beginning of the fall term—normally fourteen weeks in length.

SUMMER SCHOOL

To receive two-fifths of a unit for work in the Summer School, the candidate must register in both the Summer School and the Graduate School and must file a statement of courses satisfactory to his Special Committee. Residence credit is not allowed for less than six credit hours or for unit courses, except where two three-week unit courses are taken successively the same summer and, thereby, considered the equivalent of the six-week Summer School. By arrangement with his Committee, a candidate may secure all of his residence for the Master's degree by attending Summer School. Normally, a candidate for the doctorate may earn no more than two units for work done in summers and extramurally. However, on approval of the General Committee, a third unit may be earned in the Summer School.

DIVISION OF EXTRAMURAL COURSES

Master's degree candidates whose employment within or outside the University restricts them to *less* than one-half of a residence unit during a term may accumulate a maximum of one residence unit for work in the Division of Extramural Courses. Instruction is offered in certain fields both on and off the campus. Fifteen credit hours are the equivalent of one residence unit, and six credit hours the equivalent of two-fifths of a residence unit, which is the smallest fraction that will be recorded by the Graduate School toward fulfillment of residence requirements. Detailed information concerning extramural courses and registration procedures may be obtained from the Division of Extramural Courses, Day Hall.

CONTINUITY

A candidate is expected to register each fall and spring term until he completes all requirements for the degree. If he finds this impossible, he must apply for a leave of absence or withdraw from the Graduate School. A candidate must complete all requirements for the degree within ten years of first registration.

A candidate who wishes readmission following a leave of absence should submit a written request to the Graduate School. If he has not registered during the preceding four years, he will be permitted to re-enroll only after the General Committee has stipulated what previous residence units he may retain.

LANGUAGES

Candidates required by fields or by the Graduate School to demonstrate ability in reading French, German, or Russian, must pass general written examinations administered by the Graduate Language Examination Board at Cornell University.

A candidate who fails a language examination will not be given permission to take another examination in that language until he presents evidence of substantial further preparation.

Candidates who take examinations in languages other than French, German, or Russian should arrange with the Graduate School Office for assignment to a suitable examiner and will be allowed one month from the beginning of the term to satisfy the requirement.

INSTRUCTION IN FRENCH, GERMAN, AND RUSSIAN

Courses designed to aid graduate students in learning how to read French, German, and Russian are given by the Division of Modern Languages in cooperation with the Graduate faculty. There are two term-courses—one at the elementary and one at the intermediate level—in each of the languages. Anyone registering for them is expected to attend regularly throughout the term, take all examinations, and complete assigned work. Pressure of other work, however severe or unexpected, will not be considered a sufficient excuse to justify cancellation or withdrawal in order to avoid a failing grade.

ELEMENTARY FRENCH, GERMAN, or RUSSIAN 151. Three hours—no credit. M W F (time to be announced).

INTERMEDIATE FRENCH, GERMAN, or RUSSIAN 152. Three hours—no credit. M W F (time to be announced).

FOR THE MASTERS' DEGREES

Each field of instruction states its requirements in its own section of this Announcement. If *college entrance language* is specified, the candidate's transcript of record must indicate that he has earned three college entrance units in one language, or two units in each of two languages, or the equivalent in college study. If *proficiency* is specified, the candidate must take and pass the examination described above. Any exception to the requirement is approved by the specific field.

Any Special Committee may, at its discretion, require knowledge of foreign language beyond the announced requirements.

Since the languages offered to satisfy the requirements for the Master's degree are specified by the fields, only the languages designated as meeting the requirements for the Ph.D. degree will be accepted on a transfer of Master's to Ph.D. candidacy.

FOR THE DOCTORATE

A candidate for the degree of Ph.D. must demonstrate reading ability in two languages besides English, which have been approved as important languages of scholarship in the field of his major subject. Languages fulfilling the requirement include French, German, Russian, and such other languages as have been approved for a field by the General Committee of the Graduate School. Any Special Committee may, at its discretion, require knowledge of foreign language beyond or more specific than the requirements stated above.

Petitions for a language substitution may be submitted by an individual candidate with the approval of the Field Representative concerned and will be considered on the merit of the claim that the substituted language is also an important language of scholarship in the broad area of the candidate's field. For foreign students, the native language will be open to consideration on the same basis.

Any student who does not fulfill all the language requirements upon admission to Ph.D. candidacy is required to give satisfactory evidence to his Special Committee that he is undertaking, without delay, serious study aimed at removing the language deficiency. After two semesters in residence have elapsed, the candidate must register in courses of instruction in any languages in which he is still deficient until the requirements are satisfied. Final Examination B may not be scheduled, nor approval granted for Final Examination C, unless the requirements in language have been satisfied.

COURSES AND REGISTRATION IN COURSES

Graduate students have the privilege of registering in any University course which can accommodate them, no matter whether it is announced as primarily for graduates or undergraduates. Details regarding all offerings will be found in the Announcements of the various colleges; and to guide them to the right publication, the name of the college that lists the material has been placed after the name of the field of instruction (see pp. 44–100).

Although most graduate students undertake a considerable amount of course work and are expected by their Special Committees to give evidence of satisfactory progress in those courses, the accumulation of credit hours is not regarded

as an index of a student's progress or as a guarantee that he will receive the degree. All decisions as to courses of study are delegated to the Special Committee of the graduate student.

For the convenience of all, however, the Graduate School does require that the instructor in each course submit a grade to be entered upon the student's record; and to prevent exclusion from courses with limited enrollment, it permits a student in residence to preregister for these at an announced time during the term preceding that in which they will be offered. New students ordinarily need not preregister, but those who expect to take laboratory courses with limited facilities are advised to consult with their field representatives or major advisers.

EXAMINATIONS

The Special Committee conducts all examinations required for the degree, but the candidate is responsible for seeing that the final examinations are scheduled with the Graduate School at least seven days in advance. Formal registration as a regular student or as a "Candidate for Degree Only" is required for all Final Examinations. Any member of the Graduate Faculty is privileged to take part in questioning the candidate. The Special Committee may also require other examinations than those listed below.

The following examinations are required by the Graduate School. At the discretion of the Special Committee, they may be entirely oral or both oral and written.

FOR THE MASTERS' DEGREES: a Final Examination, which under certain conditions may be combined with the Qualifying Examination for the doctorate. (See *Code of Legislation,* pars. 97–98.)

FOR THE DOCTORS' DEGREES: (1) A Qualifying Examination to determine the applicant's fitness for undertaking advanced studies, and to enable the Special Committee to plan a program which will make him familiar with the requisite knowledge and techniques. An early date for this examination is therefore considered essential, and the Graduate School requires that all candidates complete three units of residence after passing it. (2) A Final Examination. Except by prior arrangement with the Graduate School, this must be taken in two parts—Examination A, given not earlier than the last month of the fourth unit of residence, and at least four months before the second part; and Examination B, on the thesis and related material. Final Examinations A, B, and C (A and B combined) are publicized so that any member of the Graduate faculty who wishes may attend.

THESIS OR ESSAY

Every candidate for a degree must present two copies of his thesis or essay to the Graduate School and must complete other formalities incidental to making it available in the University Library. In form, it must be as described in other publications of the Graduate School, and it must satisfy the candidate's Special Committee in both scholarship and literary quality.

Since candidates for the Masters' degrees enter upon their work with various aims and considerable variety of preparation, their Special Committees will

determine the importance of the thesis in rounding out each individual's program. Some students may use most of their time in attending courses in order to broaden their knowledge; for them the essay may be a secondary consideration. Others may concentrate upon pieces of research best handled in a thesis necessitating expenditure of much of their time and effort; the Special Committee will therefore strive to give such projects a prominent place in planning the candidate's work and in judging his success.

Doctoral theses should demonstrate that, in addition to becoming acquainted with materials and methods, the candidate possesses the ability and technique needed for carrying on original research. The faculty requires publication by abstract and microfilm.

ADVANCED PROFESSIONAL DEGREES

Advanced professional degrees * are designed as preparation and training for a special profession. The admissions, requirements, and curricula for such degrees, as approved by the Graduate faculty, are announced by the faculty of a professional school or college, which, for the purpose, acts as a division of the Graduate faculty. Degrees are awarded upon recommendation of the division to the Graduate faculty. Detailed information regarding admission or academic requirements for professional degrees is included in the Announcement of the separate school or college in which the degree is offered. Inquiries addressed to the Graduate School will be forwarded to the proper official. The professional degrees listed below are approved by the Graduate faculty.

ARCHITECTURE, FINE ARTS, LANDSCAPE ARCHITECTURE, REGIONAL PLANNING

The following four degrees are administered by the Division of Architecture and Fine Arts of the Graduate School. Inquiries should be addressed to the listed professor.

The *Announcement of the College of Architecture* should be consulted for descriptions of the requirements for these degrees.

MASTER OF ARCHITECTURE (M.Arch.) . . . Advanced training in architectural design, construction, and research. Only graduates of a five-year professional program in architecture are admitted as candidates. (Professor F. M. Wells)

MASTER OF FINE ARTS (M.F.A.) . . . Advanced training in the practice of painting or sculpture. (Professor J. A. Hartell)

MASTER OF LANDSCAPE ARCHITECTURE (M.L.A.) . . . Advanced training in landscape design. (Professor F. W. Edmondson)

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* The following are advanced degrees which are also first degrees of a school or college and therefore are not subject to the jurisdiction of the Graduate faculty. For information regarding them, address the school or college indicated:

Bachelor of Laws	Law School
Master of Aerospace Engineering	Graduate School of Aerospace Engineering
Master of Business Administration, Master of Public Administration	Graduate School of Business and Public Administration
Doctor of Medicine	Medical College, New York City
Doctor of Veterinary Medicine	Veterinary College

MASTER OF REGIONAL PLANNING (M.R.P.) . . . Training for a professional career in the fields of city planning or regional planning. (Professor J. W. Reps)

EDUCATION

The following degree is administered by the Division of Professional Teaching of the Graduate School. Detailed information may be obtained from the Graduate School.

MASTER OF SCIENCE FOR TEACHERS (M.S.T.) . . . A coordinated program of training in the biological sciences, earth sciences, and physical sciences for prospective and practicing high school teachers of sciences. This degree is administered by the Division of Professional Teaching of the Graduate School. Detailed information may be obtained from the Graduate School.

The following three degrees are administered by the Division of Education of the Graduate School.

MASTER OF ARTS FOR TEACHERS (M.A.T.) . . . The program is designed for persons who are provisionally certified to teach, having had either student teaching or full-time teaching experience, and who wish to add to their qualifications in the teaching subject of their choice.

MASTER OF EDUCATION (M.Ed.) . . . This degree is granted upon the satisfactory completion of a program of preparation for professional services in education, such as teaching, administration, student personnel work, and supervision.

DOCTOR OF EDUCATION (Ed.D.) . . . The program for this degree is designed to prepare the candidate within a broad cultural context for professional leadership in a selected field of education.

ENGINEERING

Professional degrees at the Master's level are available in most of the schools of the College of Engineering. These are degrees involving specific curricula and are administered by the Engineering Division of the Graduate School. Programs leading to the following degrees have been established:

Master of Chemical Engineering (M.Ch.E.)
Master of Civil Engineering (M.C.E.)
Master of Electrical Engineering (M.E.E.)
Master of Industrial Engineering (M.Ind.E.)
Master of Mechanical Engineering (M.M.E.)
Master of Metallurgical Engineering (M.Met.E.)

The *Announcement of Engineering Courses and Curricula* should be consulted for complete descriptions of requirements for these degrees.

INDUSTRIAL AND LABOR RELATIONS

MASTER OF INDUSTRIAL AND LABOR RELATIONS (M.I.L.R.) . . . The program leading to this degree provides a basic course of graduate study for

those with professional interests in industrial and labor relations and further provides limited opportunities for specialized professional study where broad competence has been established. This degree is administered by the Division of Industrial and Labor Relations.

LAW

The following two degrees are administered by the Division of Law of the Graduate School.

MASTER OF LAWS (LL.M.) . . . This degree is intended primarily for a student who desires to increase his knowledge of the law by working in a specialized field.

DOCTOR OF THE SCIENCE OF LAW (J.S.D.) . . . This degree is intended for a student who desires to become a proficient scholar by original investigation into the functions, administration, history, and progress of law.

MUSIC

DOCTOR OF MUSICAL ARTS (A.Mus.D.) . . . This degree is appropriate for mature composers who seek further professional training as well as knowledge of the other arts and humanities, both to enrich their creative perspectives and to prepare them for composition teaching at the university level. It is administered by the Department of Music, acting as a Division of the Graduate School for this purpose.

NUTRITIONAL AND FOOD SCIENCE

The following two degrees are administered by the Division of Nutrition of the Graduate School.

The *Announcement of the Graduate School of Nutrition* should be consulted for complete descriptions of requirements.

MASTER OF NUTRITIONAL SCIENCE (M.N.S.) . . . The basic training in this field emphasizes the physical and biological sciences that are essential for an understanding of the principles of nutrition. Through appropriate electives, students learn to apply these disciplines in either human or animal nutrition. This specialized training prepares them for positions in laboratory research, in teaching, and in applied fields such as international service, nutrition education, public health nutrition, clinic work and dietetics, and food economics; or for more advanced graduate study.

MASTER OF FOOD SCIENCE (M.F.S.) . . . The fundamental sciences, chemistry, biochemistry, and bacteriology, that are involved in food processing and utilization are emphasized. Electives are available to meet individual needs in engineering, economics, marketing, and business administration. The specialized training serves as a preparation for technical work as related to the food industry or for more advanced graduate study.

VETERINARY MEDICINE

DOCTOR OF SCIENCE IN VETERINARY MEDICINE (D.Sc. in V.M.) . . . This degree is characterized by a professional rather than a general research

objective, and it is designed especially for experienced persons in the basic and clinical sciences who need more specific, advanced, scientific, and professional knowledge in order to equip themselves for careers in teaching and research. This degree is administered by the Division of Veterinary Medicine.

GENERAL INFORMATION

TUITION AND FEES *

TUITION and fees become due when the student registers. Any student who fails to pay his tuition charges, other fees, and other indebtedness to the University, or who, if entitled to free tuition, fails to claim it at the Treasurer's Office and to pay his other fees within the prescribed period of grace, will be dropped from the University unless the Treasurer has granted him an extension of time to complete payment. The Treasurer is permitted to grant such an extension when, in his judgment, the circumstances of a particular case warrant his doing so. For any such extension the student is charged a fee of $5. A reinstatement fee of $10 is assessed against any student who is permitted to continue or return to classes after being dropped from the University for default in payments. The assessment may be waived in any instance for reasons satisfactory to the Treasurer and the Registrar, when such reasons are set forth in a written statement.

Students registering at any time during the last ten weeks of any term are required to pay tuition at the rate of 10 per cent of the regular tuition of the term for each week or fraction of a week between the day of registration and the last examination day of the term. Students registering at any time during the last five weeks in the short summer courses are required to pay tuition at the rate of 20 per cent of the term's tuition for each week or fraction of a week between the day of registration and the last examination day of the term.

Tuition or fees may be changed by the Trustees at any time without previous notice.

FEES PAYABLE BY GRADUATE STUDENTS

REGISTRATION DEPOSIT

A deposit of $28 must be made by every applicant for admission after the applicant has received notice of acceptance, unless the candidate has previously matriculated as a student at Cornell University. This deposit is used at the time of first registration to pay the matriculation fee, chest X-ray, and examination-book charge, and covers certain expenses incidental to graduation if the student receives a degree. The deposit will not be refunded to any candidate who withdraws his application after May 22 or after 20 days of his admission approval.

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* The statement is prepared by the Treasurer, who alone is authorized to interpret it.

TUITION

Tuition is $150 a term for all students registered in the Graduate School with major concentration in subjects within the state-supported colleges * of the University. Those with major work in the School of Nutrition also pay $150 a term. Tuition in the Field of Education is generally $150 except in one or two cases, where it is $657. All others must pay tuition of $657 a term. Tuition is payable at the beginning of each term.

Upon recommendation by the appropriate college dean and by action of the Controller, for each appointment in a state-sponsored school or college, waiver of tuition in the Graduate School may be made to a member of the teaching or scientific staff, whose major field of study is in a state-supported school or college.

Assistants in state-supported schools or colleges on a twelve-month appointment who are registered for Summer Research for credit in the Graduate School may be recommended for waiver of tuition during the summer period under the above limitations. This waiver of tuition does not apply if the student registers in the Summer School or is not doing productive work for the Department.

Any student who is to receive less than full residence because of his employment should apply for proration of tuition on forms procurable at the Graduate School Office. Tuition is based on residence eligibility. (See p. 6.)

A doctoral candidate whose studies have been satisfactory to the faculty is exempted from the further payment of tuition upon presenting to the Treasurer at the beginning of each term a certification from the Dean of the Graduate School that the minimum residence requirement for the degree has been completed.

COLLEGE AND UNIVERSITY FEE

A fee of $143, payable at the beginning of each term, is required of all students registered in the Graduate School. This General Fee contributes toward the services supplied by the libraries, Clinic and Infirmary, and the student union in Willard Straight Hall, and pays a portion of the extra cost of laboratory courses and general administration.

A student who is regularly registered in the Graduate School for either one or both terms of the academic year and has paid the above fee, is entitled to these services while in residence during the summer immediately following the academic year, without payment of an additional College and University or General Fee. If such a student registers with the University during the summer, he is liable for payment of any tuition and other fees, and must present his ID card at the time of payment of these charges in order to claim exemption from payment of the College and University or General Fee.

A graduate student who returns to the University to present his thesis and to take the final examination for an advanced degree, all other work for that degree having been previously completed, must register as a "Candidate for Degree Only" and pay a fee of $35.

THESIS FEE

Each doctoral candidate must pay $30 at the time of depositing the approved thesis and abstract in final form. This fee covers the cost of preparing a master

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* The state-supported colleges are Agriculture, Home Economics, Industrial and Labor Relations, and Veterinary.

microfilm of the entire thesis; of publishing the abstract in the bimonthly periodical, *Dissertation Abstracts;* of mailing the microfilm and abstract to the microfilm publisher; and of binding both copies of the thesis for deposit in the University Library.

LIMITED REFUNDS

Part of the tuition and College and University Fee will be refunded to students who officially withdraw during the first nine weeks of a term. A student arranges for withdrawal at the Graduate School Office. Students who withdraw are charged tuition and the College and University Fee at the rate of 10 per cent for each week or fraction of a week from registration to the effective date of withdrawal. No charge is made if the student withdraws within six days of registration. No part of the registration or matriculation fee is refundable.

SUMMER SCHOOL

Graduate students who attend classes in the Summer Session must register both in the Graduate School and in the Summer Session; they must pay the tuition and fees listed in the *Announcement of the Summer School.*

SUMMER RESEARCH

Students registered for Summer Research pay a minimum fee of $71.50 for a registration period of not more than eight weeks and $143 for a registration period of over eight weeks unless they were regularly registered in the Graduate School during the previous academic year. For those students desiring residence, a prorated tuition is charged in accordance with the fraction of a residence unit to be earned, based on the tuition in effect for the subsequent academic term.

A student may attend Summer School classes without paying an additional general fee, and, if the tuition paid for Summer Research is at least equal to that charged for Summer School, no additional tuition is charged.

IN ABSENTIA

A graduate student registered *in absentia* will pay a fee of $35 each term. (See *Code of Legislation,* Pars. 85–86.)

MOTOR VEHICLE REGISTRATION AND FEES

Vehicles include motorcycles, motorbikes, and motorscooters. Every student who owns, maintains, or for his or her own benefit operates a motor vehicle in Tompkins County, during the time the University is in session, must register such vehicle with the Safety Division Office, even though such vehicle may also be registered by faculty, officers, or employees. All students must register motor vehicles within the prescribed time for University registration at the beginning of the fall term. Students who acquire motor vehicles after the beginning of the fall term must similarly register them within 48 hours of their acquisition. (Students entering the University for the spring semester or summer session, or re-entering after a period of absence must register motor vehicles with the Safety Division at the time or within the time for general registration.) Students who have motor vehicles must comply with the following requirements: (1) the

student must be legally qualified to operate a motor vehicle in New York State; (2) the vehicle must be registered in New York State or legally qualified to be operated on the highways of New York State; (3) the vehicle must be effectively insured against public liability for personal injury and property damage for the minimum of $10,000–$20,000–$5,000, for the duration of such registration and while said vehicle is under the control of the registering student; (4) the registration fee covering the fall and spring terms or any part thereof is $4, and the fee for summer session is $1. The registration fee will be due and payable in the Treasurer's Office on the same date as tuition and other fees, and in the case of late registrants, within a week after such registration (a fine of $10 is levied if the vehicle is not registered within the specified time).

Suspension of the privilege of operating a motor vehicle may be enforced by requiring the student to deposit his registration plates and certificate and his driver's license with the Safety Division of the University during the period of such suspension. Refusal to comply with such a request may result in the student's suspension from the University.

STUDENT PARKING ON CAMPUS . . . Students *may not* park on campus from 8 a.m. to 5 p.m. Monday through Friday, and from 8 a.m. to 1 p.m., Saturdays. "No Parking" zones, dormitory parking areas, and areas listed as restricted for holders of F-1 and F-2 permits, are in effect 24 hours a day.

Special area parking permits are issued only after careful consideration by the Office of the Safety Division. Extenuating circumstances (physical disabilities, etc.) are the basis for the issuance of these permits.

The student's registration in the University is held to constitute an agreement on his part that he will abide by its rules and regulations with regard to traffic and parking or suffer the penalty prescribed for any violation of them. All privileges here indicated may be denied a student who is not in good standing.

Correspondence regarding motor vehicles should be addressed to the Safety Division, 101 Day Hall.

FELLOWSHIPS AND SCHOLARSHIPS

A *fellowship* ordinarily is awarded in open competition to a full-time student proceeding toward a higher degree. The award is made as a tax-exempt gift, and it covers not only tuition and fees but may also make a substantial contribution toward living expenses during tenure. A student who holds a fellowship is free to select his own research project, and his primary responsibility is to prosecute his studies for his degree. The award of the fellowship does not obligate the holder to render services to the University as an assistant in teaching or otherwise, nor does it commit him in respect to future employment. The holder of a fellowship may accept no other appointment or employment without permission of the Fellowship Board. However, teaching or research responsibilities will usually be approved as a routine matter if they contribute to the student's graduate program and do not exceed ten clock-hours of work per week.

A *scholarship* is likewise a gift and is free from income tax, but the amount of the award usually is less than that of a fellowship. It generally covers expenses such as tuition and fees (or similar cash grant) without a material contribution to living expenses. The holder of a scholarship may, on approval of the Fellowship Board, accept limited employment.

Both fellowships and scholarships are awarded primarily on the basis of scholastic ability and promise of achievement as a graduate student. Financial need will also be considered in the award of scholarships but not of fellowships.

Application for a fellowship or scholarship is made to the Graduate School, 125 Day Hall, Cornell University, on a form obtained from that office. (Foreign students outside the country do not submit a formal application.) The applicant either must be a matriculated student in the Graduate School or must have filed an application for admission with necessary credentials. Filing application for admission does not obligate the applicant. *The applications for admission and fellowship or scholarship should be filed simultaneously.*

Under the rules of the Association of Graduate Schools, the regular time for notification of award of fellowships and scholarships for an academic year is April 1. *All fellowship and scholarship applications received by the deadline date (see Calendar) will be considered for April 1 awards, and on that day each applicant will be notified as to whether he has or has not been awarded a fellowship or scholarship or named as an alternate.* The applicant is allowed until April 15 to notify the Graduate School whether or not he will accept the award. Applications received after February 1 may be considered at a later date if vacancies occur due to withdrawal of principals and alternates or for other reasons. Fellowships and scholarships are usually granted for an academic year but under some conditions may be awarded for a single semester. Scholarships are also available for the Summer Research period.

The locally administered fellowships and scholarships available for 1963–1964 are listed below.* Tuition for the academic year for students whose major work is in fields of the *endowed* institutions is $1314, and for students whose major work is in fields of the *state* institutions, it is $300. The College and University *(CU)* fee, included below, is $286 for all graduate students. No other fees are covered in an award, unless specifically stated.

The Graduate School Office also maintains various files of fellowships and scholarships administered by foundations and state and national agencies. Each year several hundred Cornell graduate students receive support from these outside sources.

OPEN TO APPLICANTS IN ALL FIELDS

Cornell Senior Graduate Fellowships, $2500 plus tuition and CU fee
To be awarded to doctoral candidates in their final year of graduate study. A travel allowance may be granted in lieu of tuition.

Andrew Dickson White Fellowships, $3000 plus tuition and CU fee
To be awarded to first-year students of truly exceptional promise, with provision for renewal for two additional years on recommendation of the major field.

Andrew Dickson White Fellowships, $2500 plus tuition and CU fee
To be awarded in each area to a first-year student of truly exceptional promise.

Cornell Graduate Fellowships, $2000 plus tuition and CU fee
Intended for outstanding first-year or continuing students.

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* The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

Cornell Graduate Teaching Fellowships, $2000 plus tuition and CU fee
To be awarded to outstanding graduate students beyond the first year of study who have rendered or are expected to render distinguished service as departmental teaching assistants. The appointment provides a fellowship of $1000 plus tuition and CU fee in addition to a departmental salary of $1000 for teaching services requiring up to ten clock-hours per week during the academic year.

Allen Seymour Olmsted Fellowships, $1500 plus tuition and CU fee
Two to be awarded. Preference will be given to students beyond the first year of graduate study.

Cornell-Glasgow Exchange Fellowship
One to be awarded for study at the University of Glasgow. Includes tuition, board and room, plus £120 and an allowance of $400 for travel. Limited to graduate students at Cornell. Preference given to doctoral candidates. One to be awarded for study at Cornell University to a matriculated student at Glasgow University. Includes a stipend of $2000 plus tuition and CU fee, the registration deposit, and a Fulbright travel grant from Scotland to the United States and return.

German Fellowships
Cornell graduate students needing to do research or study in German universities may apply to the German Scholarship Committee, Professor Eric A. Blackall, Chairman, for information on the availability of German Fellowships which provide tuition, fees, and maintenance. Four are available, of which one is at the University of Heidelberg and one at the University of Göttingen. Two of the four fellowships provide travel allowances.

Travel Grants ranging up to $500
To be awarded for use in thesis research.

Tuition and CU Fee Scholarships
To assist well-qualified students whose financial resources would not be adequate to maintain them during their period of study. A statement of financial need is required.

Summer Research Scholarships ranging up to $750
Primary consideration will be given to doctoral candidates in their terminal year of study. All applicants must have maintained superior scholastic standing and show evidence of financial need.
Applications for these scholarships are to be filed between April 1 and May 1.

OPEN TO MORE THAN ONE AREA

Academic Year Institute for Secondary School Teachers of Biology, Chemistry, Earth Science, Mathematics, and Physics
If continued in 1963–1964, the Cornell AYI will provide stipends for 30 secondary school and 10 junior college participants from funds provided by the National Science Foundation. Inquiries should be directed to the Graduate School, prior to December 1, 1962.

China Program Fellowships ranging up to $2500 plus tuition and CU fee
Open to candidates in the China Program. Apply to the Director of the Program, Franklin Hall.

Southeast Asia Program Fellowships ranging up to $2500 plus tuition and CU fee
Open to candidates in the Southeast Asia Program. Apply to the Director of the Program, Franklin Hall.

London-Cornell University Fellowships ranging from $2000 to $3000 plus air fares and tuition and fees
Tenable at the London School of Economics and Political Science and the School of Oriental and African Studies of the University of London. Open to advanced candidates in the China Program and Southeast Asia Program. Apply to the Director of either Program, Franklin Hall.

London-Cornell Field Fellowships ranging up to $12,000 including travel and research expenses for a two-year period.
Open to candidates in the China Program and Southeast Asia Program. Apply to the Director of either Program, Franklin Hall.

* *Cornell Sigma Xi Fellowship,* $2400 plus tuition and CU fee
Open to candidates in the Field of Anthropology and the Areas of the Biological and Physical Sciences. May be available in 1963–1964.

Henry Strong Denison Fellowships in Agriculture, $1000 plus tuition and CU fee
Two available to candidates in the plant sciences, animal sciences, agricultural engineering, agricultural economics, rural education, and rural sociology. Preference will be given to those applicants who expect to complete the requirements for the doctorate and who appear most promising from the standpoint of ability to conduct research. In certain instances these fellowships may be combined with part-time employment.

International Studies Fellowship, $3000 plus CU fee
Open to Ph.D. candidates who have passed Examination A, or the equivalent, and whose research will make a significant contribution to international studies.

Clinton DeWitt Smith Fellowship in Agriculture, $1200 plus tuition and CU fee
Open to students who come from farm homes and who have had farm training.

* *General Foods Fellowships in Home Economics,* $2000 to $3000 with adjustment for tuition and CU fee

Katharine Wyckoff Harris Fellowship in Home Economics, $2000 plus tuition and CU fee
Open to candidates majoring or minoring in one of the Fields of Home Economics. Preference will be given to candidates in the Field of Institution Management.

Anna Cora Smith Scholarship in Home Economics ranging up to $214 plus tuition and CU fee

Flora Rose Fellowship in Home Economics, $500 plus tuition and CU fee

HUMANITIES

OPEN TO MORE THAN ONE FIELD

H. C. Berkowitz Fellowships, $2000 plus tuition and CU fee
Available to Ph.D. candidates with concentration in Romance literature and linguistics.

George Lincoln Burr Fellowship, $1900 plus tuition and CU fee
Open to Ph.D. candidates concentrating in medieval and Renaissance study. For specific information write to the Chairman, Interdepartmental Committee on Medieval and Renaissance Studies. Goldwin Smith Hall. (See p. 36.)

Florence May Smith Fellowships, $1800 to $2000 plus tuition and CU fee
Two available to students in the classics, Romance literature, or German literature. Preference will be given to students of the classics.

ARCHITECTURE

University Scholarship, $114 plus tuition and CU fee

CLASSICS

University Scholarships in Greek and Latin, $400 plus tuition and CU fee

University Fellowships in Greek and Latin, $2000 plus tuition and CU fee

ENGLISH LANGUAGE AND LITERATURE

Class of 1916 Graduate Fellowship, $1500 plus tuition and CU fee

Martin Sampson Teaching Fellowship, $1500 plus tuition and CU fee
Combination of $500 scholarship and $1000 assistantship for services as a teaching assistant not to exceed ten clock-hours per week during the academic year.

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* The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

PHILOSOPHY

Susan Linn Sage Fellowship, $2000 plus tuition and CU fee

ROMANCE STUDIES

University Fellowship, $800 plus tuition and CU fee

SOCIAL SCIENCES

BUSINESS AND PUBLIC ADMINISTRATION

Theodore P. Wright Fellowship of Cornell Aeronautical Laboratory, $2000 to $3400 plus tuition and CU fee
Open to either Master's or Ph.D. candidates. An additional $600 is available for married candidates.

CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS

**National Institute of Mental Health Traineeships,* $1514 to $2714 plus tuition and CU fee
Two available.

ECONOMICS

President White Fellowship, $1000 plus tuition and CU fee

Robert Irving Warshow Fellowship, $2000 plus tuition and CU fee

EDUCATION

Comstock Scholarship in Nature Study, $400 plus tuition and CU fee, available 1964–1965

HISTORY

George C. Boldt Fellowship, $1380 plus tuition and CU fee

Gertrude A. Gillmore Research Fellowship, $1500 plus tuition and CU fee
Open to women students, ordinarily in the last year of work for the doctorate.

President White Fellowship, $1100 plus tuition and CU fee

Mommsen Traveling Fellowship, $2000
Open to students majoring in medieval and Renaissance studies to finance travel to Europe for the purpose of study and research on a doctoral dissertation approved by the Field of History.

HOUSEHOLD ECONOMICS AND MANAGEMENT

Helen Canon Scholarship in Home Economics, $240 plus tuition and CU fee

HOUSING AND DESIGN

Ed Gavin Memorial Housing Scholarship, $414 plus tuition and CU fee

INDUSTRIAL AND LABOR RELATIONS

Ford Foundation Master Fellowship, $2414 plus tuition and CU fee
Open to doctoral candidates working on full-time thesis research on topics having to do with the application of the behavioral sciences to problems of the business institution.

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* The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

Industrial and Labor Relations Graduate Fellowship, $2414 plus tuition and CU fee
Preference given to doctoral candidates.

Tuition Scholarships
Four available. CU fees not included. Primarily for foreign students.

TEXTILES AND CLOTHING

Margaret L. Brew Memorial Fellowship in Home Economics, $2000 plus tuition and CU fee

BIOLOGICAL SCIENCES

OPEN TO MORE THAN ONE FIELD

**Allied Chemical Corporation Fellowship,* $2000 plus tuition and CU fee
Available to candidates in the Field of Entomology in 1964–1965 and those in the Field of Plant Pathology in 1963–1964. Candidates must be U.S. citizens, preferably in final year of the doctorate.

**Shell Fellowship in Plant Science,* $1800 or $2100 plus tuition and CU fee
Higher stipends are available to married candidates with children. Open to candidates in the Fields of Agronomy, Botany, Floriculture, Plant Breeding, Plant Pathology, Pomology, and Vegetable Crops. Preference will be given to applicants in the second or third year of graduate study. Applicant must be United States or Canadian citizen.

Schuyler-Gage Fellowship in Animal Sciences, $1400 plus tuition and CU fee
Open to candidates in the Fields of Biochemistry, Conservation, Entomology, and Zoology.

Woods Hole Summer Scholarships, $150
Stipend to cover tuition for a six-week summer session at the Marine Biological Laboratory, Woods Hole, Massachusetts.

ANIMAL HUSBANDRY

Morrison Fellowship in Livestock Feeding, $2000 plus tuition and CU fee

BIOCHEMISTRY

National Institutes of Health Traineeships, $2600 plus tuition for entering students
Appointments are on a twelve-month basis.

ENTOMOLOGY

Comstock Scholarship, $400 plus tuition and CU fee
Available 1963–1964.

FLORICULTURE AND ORNAMENTAL HORTICULTURE

Alfred Hottes Amateur Gardening Fellowship, $1290 plus tuition and CU fee

FOOD SCIENCE

National Institute of Health Traineeships ranging from $3000 up plus tuition on a twelve-month basis. Available to predoctoral and postdoctoral candidates.

PSYCHOLOGY

Susan Linn Sage Fellowship, $1200 plus tuition and CU fee

Dallenbach Fellowship, $1800 plus tuition and CU fee

National Institute of Mental Health Traineeships, $1800 plus tuition and CU fee

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* The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

PHYSICAL SCIENCES

OPEN TO MORE THAN ONE FIELD

Special Graduate Fellowships in Engineering
New and continuing graduate students studying toward the degree of Ph.D. in any of the Fields of Engineering are eligible for special fellowships provided by a grant to the College of Engineering by the Ford Foundation. These fellowships are for study during a twelve-month period and may be combined with teaching or research assistantships to provide a maximum annual total of $3400, of which not more than $2200 may be provided from the special fellowship. Opportunity is also provided for loans to graduate students which are forgivable to those who undertake college teaching after completing their doctoral studies. Inquiries may be directed to Field Representatives in engineering or to the Graduate School.

Frederick W. Lanchester Fellowship of Cornell Aeronautical Laboratory, $2000 to $3400 plus tuition and CU fee
Provision for additional $600 if candidate is married. Applicants must be qualified for a commission in the Reserve of one of the Armed Forces, or in the Regular Army or Air Force. The fellowship is available only during the year following the receipt of the baccalaureate degree. For further details concerning eligibility criteria, consult the Fellowship Secretary in the Graduate School Office.

John McMullen Graduate Fellowship, $2000 plus tuition and CU fee
One available in each Field of Engineering. Applicants should apply directly to the Field Representative.

Hannibal Ford Fellowship, $2500 plus tuition and CU fee
Available to students who are American citizens and in their first year of graduate study, or to those who have completed no more than a limited amount of auxiliary study at the graduate level in the Fields of Electrical Engineering, Mechanical Engineering, Engineering Physics, or Engineering Mechanics and Materials.

**IBM Fellowship,* $1800 plus tuition and CU fee
Provision for an additional $700 if candidate is married and has at least one child. Open to candidates in the Fields of Engineering Physics, Mathematics, Electrical Engineering, and Industrial Engineering and Operations Research, and to doctoral candidates in other disciplines in which the research problems will involve the use of a digital computer.

**Eastman Kodak Fellowship in Engineering,* $1500 plus tuition and CU fee
Open to candidates majoring in the Fields of Chemical, Mechanical, or Electrical Engineering. Preference given to United States citizens.

**Alfred P. Sloan Engineering Fellowships,* $1800 plus tuition and CU fee
Provision for additional $600 if recipient is married. Two available to first-year graduate students in engineering. Applicants must be male and United States citizens. Recipients may accept part-time teaching assistantships of no more than a total of ten clock-hours per week.

**Raytheon Fellowship,* $1900 plus tuition and CU fee
Provision for additional $300 if recipient is married and has at least one child. Open to candidates in the Fields of Electrical Engineering and Physics. Award to be made to Ph.D. candidate in his final year of study or, at most, two years before completion of degree requirements.

**Emmet Blakeney Gleason Fellowship,* $2500 plus tuition and CU fee
Open to outstanding candidates in the Fields of Electrical Engineering, Engineering Mechanics and Materials, and Mechanical Engineering.

AEROSPACE ENGINEERING

The *Theodore von Karman Fellowship,* the *Hermann Glauert Fellowship,* the *Ernst Mach Fellowship,* and the *Ludwig Prandtl Fellowship, all of Cornell Aeronautical Laboratory,*

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* The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

each provide from $2000 to $3400 plus tuition and CU fee and a dependency allowance of $600 for married fellows.

CHEMICAL ENGINEERING

**Esso Education Foundation Fellowship,* $2400 plus tuition and CU fee
Provision for additional $600 if recipient is married and has at least one child. Open to graduate students who have completed at least one year of graduate work.

**Procter & Gamble Fellowship,* $1800–$2100 plus tuition and CU fee
First or second year graduate: $1800. Final year of Ph.D.: $2100. Applicants must be male American citizens studying for either the Master's or the Doctor's degree.

**Standard Oil Company of California Fellowship,* $1800 plus tuition and CU fee
Provision for additional $600 if recipient is married and has at least one child.

**Texaco Fellowship,* $1500 plus tuition and CU fee

**Union Carbide Fellowship,* $1800 plus tuition and CU fee
Provision for additional $300 if recipient is married. Fellowship alternates with Field of Mechanical Engineering.

CHEMISTRY

†American Cyanamid Company Summer Research Scholarships, $375

†American Viscose Corporation Summer Research Scholarships, $375

†Dow Chemical Company Summer Research Scholarships, $375

†M. W. Kellogg Company Summer Research Scholarships, $375

†Procter and Gamble Company Summer Research Scholarships, $375

**Corning Glass Works Fellowship,* $2900 plus tuition and CU fee (12-month tenure)

**Esso Education Foundation Fellowship,* $2400 plus tuition and CU fee
Provision for additional $600 if recipient is married and has at least one child. Applicants should have completed at least one year of graduate study.

**General Electric Company Fellowship,* $2400 plus tuition and CU fee (12-month tenure)

**Gulf Research and Development Company Fellowship in Physical Chemistry,* $2000 plus tuition and CU fee
Preference given to Ph.D. candidates who have completed at least one year of graduate study.

**Procter and Gamble Fellowship,* $1800 plus tuition and CU fee
Provision for additional $300 if recipient is married.

**Sprague Electric Company Fellowship,* $2500 plus tuition and CU fee

Todd Fellowship in Chemistry, $1800 plus tuition and CU fee

**Union Carbide Corporation Fellowship,* $2100 plus tuition and CU fee

**United States Rubber Company Foundation Postgraduate Fellowship,* $1800 plus tuition and CU fee
Provision for additional $300 if recipient is married and has at least one child under school age. Applicants must be male citizens of United States doing research in fields of physical and engineering science. Not open to employees of the U.S. Rubber Co. nor to those directly related to such employees.

**DuPont Teaching Assistantship,* $3200 plus tuition and CU fee

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* The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

†The Summer Research Scholarships are available for the summer of 1963.

CIVIL ENGINEERING

Elon Huntington Hooker Scholarship in Hydraulics, $240 plus tuition and CU fee ‡

McGraw Scholarship, $114 plus tuition and CU fee ‡

University Scholarship, Tuition and CU fee ‡

ELECTRICAL ENGINEERING

Michael Faraday Fellowship of Cornell Aeronautical Laboratory, $2000 plus tuition and CU fee
Provision for an additional $600 if recipient is married.

James Clerk Maxwell Fellowship of Cornell Aeronautical Laboratory, $2000 plus tuition and CU fee
Provision for an additional $600 if recipient is married.

United States Steel Foundation Fellowship, $1500 plus tuition and CU fee
Provision for an additional $600 if recipient is married.

Charles Bull Earle Memorial Graduate Fellowship, $600 plus tuition and CU fee
Supplementary funds available if needed.

ENGINEERING PHYSICS

**Radio Corporation of America Fellowship,* $2100 plus tuition and CU fee
Recipient must be a U.S. citizen or declare intention to remain in U.S. as resident.

**Avco Graduate Fellowship,* $1800 plus tuition and CU fee

**Owens-Corning Fiberglas Fellowship,* $2000 plus tuition and CU fee

GEOLOGY AND GEOGRAPHY

Eleanor Tatum Long Fellowship, $1500 plus tuition and CU fee

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Procter and Gamble Fellowship, $1500 plus tuition and CU fee
Provision for an additional $700 if recipient is married.

MATHEMATICS

Erastus Brooks Fellowship, $1800 plus tuition and CU fee

MECHANICAL ENGINEERING

Edgar J. Meyer Graduate Fellowship, $1950 plus tuition and CU fee

Sibley Scholarship, $114 plus tuition and CU fee

**Union Carbide Fellowship,* $1800 plus tuition and CU fee
Provision for additional $300 if recipient is married. Fellowship alternates with Field of Chemical Engineering.

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*The Special Temporary Fellowships are marked with an asterisk, and their listing is based on their availability for the academic year 1963–1964.

‡The scholarships in civil engineering may be supplemented by McMullen funds to provide stipends up to $1200.

METALLURGICAL ENGINEERING

J. Heber Parker Fellowship, $2000 plus tuition and CU fee

PRIZES

Several University prizes are open for competition to all students, including graduate students; the Committee on Prizes of the University faculty publishes an *Announcement of Prize Competitions*, which may be obtained from the Visitor Information Center, Day Hall.

Two other prizes are open exclusively to graduate students:

THE GUILFORD ESSAY PRIZE . . . Until at least 1964 a special prize of $120 will be assigned annually to that graduate student who, in the judgment of the Graduate faculty, writes the best English prose. Each competitor must submit, at or before 12 o'clock of the last Monday in November, specimens of his English prose, preferably prepared as a normal part of his training in candidacy for an advanced degree.

THE PHILOSOPHY PRIZE . . . A prize of $50 is awarded to the graduate student who submits the best paper embodying the results of research in the field of philosophy. The subject of the paper may be historical or critical or constructive. It may be concerned either with problems of pure philosophy or with the philosophical bearing of the concepts and methods of the sciences. Papers must be submitted on or before the first day of May.

Papers submitted in competition for either prize must be typewritten on bond paper (a clean *ribbon* copy), double-spaced, at least 1500 and not more than 5000 words in length, and signed with an assumed name, the real name and address of the competitor being enclosed in a sealed envelope, superscribed with the assumed name. They are to be deposited in the Office of the Graduate School. A student may not submit more than one paper.

LOANS

University and National Defense student loans and other loans for special groups are available to graduate students enrolled in Cornell University. The actual amount that may be borrowed is based on financial need. Applications should be made to the Office of Scholarships and Financial Aid, Day Hall. Applications for New York Higher Education Assistance Corporation Loans may also be obtained from the Office of Scholarships and Financial Aid.

ASSISTANTSHIPS

The colleges, schools, and departments of the University regularly contract for the assistance of graduate students in teaching, research, and administration. The contracting parties and the faculty of the Graduate School see that appointments and assignments of duties are made with proper consideration for the candidate's graduate program. Usually the duties of the assistant lie in the field of his major interest and contribute to his intellectual and technical proficiency in the field. Assistants are eligible for residence units in candidacy for advanced degrees according to regulations of the Graduate faculty. (See p. 6.)

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* The Special Temporary Fellowships are marked with an astrisk, and their listing is based on their availability for the academic year 1963–1964.

Normally an assistant is called upon for services not exceeding 20 clock-hours a week. Assistantship stipends have a wide range, but an appointment ordinarily would at least cover the cost of room and board and tuition and fees. Those desiring appointment should apply to the head of the department concerned. Applications addressed to the Graduate School are forwarded to the proper department.

RESIDENCE HALL ASSISTANTSHIPS

Approximately 35 residence assistantships in the University residence halls are available for men and women graduate students. One third of these are awarded to students in the Graduate Program in Student Personnel Administration. The remainder are open to students in any academic field. They are most appropriate for those who desire the experience of working with staff and undergraduate students while contributing financially to their own study.

Six assistantships are available to married men; remuneration includes a furnished apartment plus stipend. The remainder of the residence assistantships are for single men and women. Remuneration varies from room only, to room, board, and stipend, depending on responsibilities.

Applications should be addressed to the Office of the Dean of Students, 133 Day Hall.

OTHER EMPLOYMENT

Additional opportunities for part-time work are often available in connection with departmental research projects or other activities. Applications for this type of work should be made directly to the department concerned. If a candidate is employed in research or other work closely allied to his academic interest, he may find such employment valuable.

Progress in candidacy is difficult when a student attempts to support himself wholly or partially by work unrelated to his field. It usually is sounder economy to borrow from the Office of Financial Aids and keep employment to a minimum. The University maintains a part-time student employment service, however, in the Office of Scholarships and Financial Aid.

LIVING ARRANGEMENTS

DORMITORY ACCOMMODATIONS . . . The University has established Sage Hall as a graduate residential center. Its dormitory facilities accommodate approximately 100 men in the north side of the building and 105 women in the south side. The Graduate Center, which is available for use by all graduate students and faculty, also contains a cafeteria seating 200, study rooms, and lounges.

Applications for dormitory accommodations may be made any time after January 1 for the coming academic year by writing the Department of Residential Halls, 223 Day Hall.

FAMILY ACCOMMODATIONS . . . The University, through the Department of Residential Halls, has three apartment developments for married students and their families. They are Cornell Quarters, Pleasant Grove Apartments, and

Hasbrouck Apartments, with total housing for about 400 families. All apartments are unfurnished. For further information and application, write the Department of Residential Halls, Room 223, Day Hall.

The Department of Residential Halls also maintains a list of available rental housing in the Ithaca area. Information on housing currently available can be obtained only at the Off-Campus Housing Office, Room 223, Day Hall. Lists cannot be sent out because changes occur daily. Students desiring off-campus housing should come to Ithaca well in advance of the term opening to arrange for such accommodation.

COUNSELING

The University maintains a variety of counseling services available to graduate students. The primary academic counselors are the members of the Special Committee. Other counselors who are able to help in personal matters of various kinds will be found in the Office of the Dean of Students, the Office of Scholarships and Financial Aid, the International Student Office, the Gannett Medical Clinic, and the Sage Graduate Center.

PLACEMENT

The University Placement Service makes arrangements for interviews on and off campus with employers, supervises the assembling and presentation of personnel records, and assists Cornell men and women who are ready for positions in business and industry. The Educational Placement Service performs a similar function for those whose vocation is teaching. Many of the professional schools and colleges maintain separate placement offices for the special professions; their services are available to registered graduate students and alumni.

MILITARY SCIENCE

The advanced course in military science (elective) is open to graduate students who have satisfactorily completed a basic course in ROTC while undergraduates and who are enrolled in a two-year graduate program leading to a degree. Successful completion of the two-year advanced course will qualify a graduate student for appointment as a Second Lieutenant in the U.S. Army Reserve or the Regular Army. Interested graduate students should consult the *Announcement of Military Training* and apply to the Professor of Military Science, Barton Hall.

FOREIGN STUDENTS

Applications and all necessary credentials for admission should be filed by foreign students several months before registration day. No student should apply who has not mastered colloquial English.

Before applying, a student from another country should be certain that he has sufficient available funds in dollars to meet all necessary expenses. Because of his unfamiliarity with local patterns of living and buying, he will need to calculate a somewhat higher amount for board, room, and travel than the amounts cited in this Announcement and elsewhere. He should, also, make arrangements for

additional help in the event of protracted illness or other emergency. *Students from foreign countries whose native language is not English or whose preparation differs from that of citizens of the United States should not expect to receive their degrees at the end of the minimum residence period.* Moreover, agencies subsidizing such students should be prepared to support them for a longer period. Such students are usually unable to qualify for assistantships or for other appointments yielding financial assistance during the first year of residence. Within these limits, Cornell University welcomes students from other countries.

In 1961–1962 there were approximately 800 foreign students from 79 countries enrolled at the University. The University maintains an International Student Office, and foreign students are invited to write to that office for any information they may need, or to consult the staff about any problems they may have. It is suggested that foreign students report to the International Student Office, 142 Day Hall, when they arrive at Cornell.

HEALTH SERVICES AND MEDICAL CARE

The health services and medical care of Cornell students are centered in the University's Gannett Medical Clinic (out-patient department) and in the Cornell Infirmary (hospital). Students may consult a physician at the Clinic whenever need arises and receive treatment in cases that do not require hospitalization. If hospital care is indicated, the student is requested to enter the Infirmary. For details of the health and medical services covered by the student's College and University General Fee, see the *Announcement of General Information.* On a voluntary basis insurance is available to supplement the services provided by the General Fee; information about such insurance may be obtained at the Gannett Medical Clinic.

If a student prefers to consult a private physician rather than go to the Clinic, or to have the services of a private doctor while a patient in the Infirmary, he must bear the cost of these services.

HEALTH REQUIREMENTS ON ENTRANCE

The following health requirements for entering graduate students have been adopted by the Board of Trustees of Cornell University. Failure to fulfill these requirements may result in loss of the privilege of registering the following term. The responsibility for fulfilling these requirements rests upon the student.

IMMUNIZATION

A satisfactory certificate of immunization against smallpox, on the form supplied by the University, must be submitted before registration. It will be accepted as satisfactory only if it certifies that within the last three years a successful vaccination has been performed. If this requirement cannot be fulfilled by the student's home physician, opportunity for immunization will be offered by the Cornell medical staff during the student's first semester, with the cost to be borne by the student. If a student has been absent from the University for more than three years, immunity will be considered to have lapsed and a certificate of revaccination must be submitted.

HEALTH HISTORY

Students accepted for admission will be required to submit health histories on forms supplied by the University.

X-RAY

Every student is required to have a chest X-ray. He may present a chest film made by a private physician on or before entering Cornell, provided that it was obtained within six months of initial registration and is of acceptable quality; *or* he may present a chest X-ray report, provided that the radiograph was taken within six months of initial registration, contains the film number and name and address of the X-ray facility, and is signed by a radiologist; *or* he may have a chest X-ray at Cornell during the orientation period or at some other specified time shortly thereafter, in which case the charge will be included in the registration fee.

When a student who has been away from the University for more than a year wishes to re-enter, he must, at his own expense, once more fulfill the chest X-ray requirement, and must also submit a new health history.

ACTIVITIES FOR GRADUATE STUDENTS

There are places for graduate students in some extracurricular activities shared by undergraduates, such as intramural sports, drama, publications, music and the other arts, and additional areas of special interest. In the main, however, by reason of maturity and different interests, graduate students have their own organizations. More than twenty-five such organizations center in academic fields or groups of fields; some are purely social, others informally academic. Information on these groups is available in the Office of the Dean of Students and the Office of the Graduate School.

WILLARD STRAIGHT HALL AND THE SAGE GRADUATE CENTER provide facilities for graduate groups and aid in planning special functions for them.

CORNELL UNITED RELIGIOUS WORK (CURW) includes a range of activities for graduate students. Its offices are in Anabel Taylor Hall, which serves as the headquarters for chaplains who represent several denominations and who may be consulted by students.

SAGE CHAPEL, where nonsectarian services each Sunday are led by distinguished guest speakers, is maintained by the University. Graduate students are eligible for its trained choir.

CORNELL'S LOCATION in the Finger Lakes region of New York State stimulates outdoor activity. Agencies of the University operate an outdoor swimming pool, a golf course, a ski run with ski tow (twelve miles from the campus), riding classes, and other outdoor facilities. There are three large state parks within ten miles of the campus. Departments of the University plan field trips for various purposes, including ornithological, geological, agricultural, and industrial, which are open to interested graduate students.

RESOURCES FOR RESEARCH AND ADVANCED STUDY

For many fields of study offered at Cornell, substantial collections and facilities, in many instances unique, have been assembled for the use of graduate students, though they cannot be described in this Announcement. The Graduate School does not conduct programs leading to advanced degrees in fields inadequately equipped for such purposes.

The descriptions below are limited to major general facilities at the service of graduate students in any of a variety of fields of instruction.

OFFICE OF COORDINATOR OF RESEARCH

Established in part to aid members of the faculty in arranging for outside sponsorship, chiefly by industry, government, and foundations, of cooperative research programs of interest and concern to faculty and their students, this office advised and assisted in administering research projects in the University to the amount of more than $39,000,000 during 1960–1961. All phases of human endeavor were represented, the largest being 38.3 per cent in aeronautics (the work of Cornell Aeronautical Laboratory at Buffalo). The remainder represents substantial research programs in agriculture, medicine and nutrition, the social sciences, the physical and biological sciences, engineering, and the humanities. In addition to these projects aided by outside sponsors, there is a large amount of unsponsored research by departments and individual staff members supported by the University itself as a continuing part of the normal professional activity of its members. The office of the Coordinator of Research works closely with the Graduate faculty in supporting research programs which properly advance the education and training of graduate students, including industrially sponsored fellowships.

RESEARCH CENTERS

MATERIALS SCIENCE CENTER

The Materials Science Center (MSC) at Cornell is an interdisciplinary laboratory set up to promote research and graduate student training in all phases of the science of materials. The subjects of study represented in the MSC program are chemistry, electrical engineering, engineering mechanics and materials, engineering physics, metallurgy, and physics.

The extent of the benefits a graduate student may derive from the MSC program depends on the actual research he pursues. If the student chooses to follow the more conventional course of becoming a specialist in one specific area, some of the ways the MSC program could help him would be to provide new equipment; to provide, in some cases, the help of a technician to carry out routine measurements; and to provide financial assistance through research assistantships.

If the student wishes to follow a program of considerably more breadth than usual in his research training, the MSC program provides an additional advantage. Several central facilities have been set up where more specialized apparatus such as crystal-growing furnaces, high-pressure equipment, X-ray and metallography equipment, electron microscopes, etc., are available to all MSC

members and their students. In addition to the equipment, expert advice on its use and the interpretation of the results will be available. In these central facilities, it is expected that the student will come in contact with students from other disciplines, resulting in a mutually profitable interaction.

The Director of the Materials Science Center is Professor R. L. Sproull, 236 Thurston Hall.

CENTER FOR RADIOPHYSICS AND SPACE RESEARCH

A Center for Radiophysics and Space Research has been organized to conduct graduate programs and research in:

1. Radio investigations of the atmosphere, moon, Venus, Mars, and properties of space in the vicinity of the earth and near-by planets.
2. The development of space vehicle instrumentation for the study of the gases of the solar system.
3. The use of radio astronomy for investigating solar, galactic, and extragalactic phenomena.

A radar antenna 1000 feet in diameter, designed for use in many of these investigations, is under construction in Puerto Rico and should be ready for research purposes early in 1963. In addition, numerous laboratory studies will be carried on. The Center provides opportunities for faculty and graduate students in astronomy, engineering physics, electrical engineering, physics, and aerospace engineering to collaborate in advancing the understanding of space.

Additional information may be obtained by writing to Professor T. Gold, Director, Center for Radiophysics and Space Research, Newman Laboratory.

SOCIAL SCIENCE RESEARCH CENTER

The Center is an organization designed to encourage and facilitate research in all major fields of the social sciences and to promote, whenever desirable and feasible, interdisciplinary cooperation in program development and research endeavor. Its services are available to individual faculty members and organized staff groups in all schools and colleges of the University. Apart from a limited program of direct financial support, the Center services involve assistance in planning and development of programs and research projects. The Center does not itself engage in research, however, nor directly provide technical services. Rather, with minor exceptions, its assistance takes the form of bringing together persons of similar interests or of channeling inquiries and problems to appropriate campus agencies and individuals.

Services to graduate students in the past have assumed varied forms, including provision of information regarding research activities, both on and off campus, and a program of limited grants-in-aid to advanced graduate students. For the most part, however, as a facilitating rather than operating agency, the Center's services to graduate students have been indirect. A major, although incidental, benefit has been the opportunity for graduate students to participate in certain of the Center-sponsored workshops and faculty seminars. Inquiries concerning present programs and services available should be addressed to the Center offices.

The Director of the Center is Associate Professor Wayne E. Thompson. The offices of the Center are in the Industrial and Labor Relations Research Building.

STATISTICS CENTER

The methods of statistics find important applications in many diverse fields of research. It is therefore necessary that (1) subject matter specialists be able to obtain assistance in using or developing statistical theory, (2) students who intend to do research in a particular field which makes extensive use of statistical methods receive adequate training in statistics, and (3) individuals be trained as statisticians.

The staff members of the various schools and colleges of Cornell University who are interested in the development and application of statistical methods are associated in the Cornell Statistics Center. A major responsibility of the Center is to provide a focal point to which individuals, projects, and departments may come to receive assistance and guidance with respect to the statistical aspects of research and training programs.

The Director of the Center is Professor Philip J. McCarthy, Ives Hall.

COMPUTING CENTER

The Center provides complete computing facilities for the Cornell community, both faculty and students. It is equipped with a Burroughs 220 Computer and a Control Data Corporation 1604–160A Computer, as well as a variety of associated, peripheral equipment. The Center maintains a staff of programers, operators, and technicians.

The Center is designed to service both the nonsponsored and sponsored research needs of the University. Facilities are available free of charge for nonsponsored faculty and student research. Consultation on programing methods is available for students, and students are allowed to run their own problems on the equipment.

Seven or eight graduate students are employed on the staff in teaching-assistant positions to serve as consultants to their particular fields of activity.

For further information about the Computing Center, write to the Director, Professor Richard C. Lesser, Computing Center, Rand Hall.

WATER RESOURCES CENTER

The Center is an organization designed to encourage graduate study and research in the Field of Water Resources with a strong correlation to subjects in many other fields. A comprehensive program in water resource planning and management will be related to the sciences, to engineering, to law, and to economics.

As demands on the water resources of the world increase, persons in many disciplines and professions are becoming more closely related to and implicated in the problems of water resource management. The aim, therefore, of the Center is to enable persons majoring in any one of many disciplines to study, as a minor, water resources, and to develop, through research, the relationship of this subject to those disciplines that constitute the student's major and other minor subjects. To this end the staff of the Center will include those faculty members whose interests are related in any way to the subject of water resources.

For further information see the section in this Announcement on water resources or write to the Director, Professor C. D. Gates, Water Resources Center, Carpenter Hall.

CENTER FOR HOUSING AND ENVIRONMENTAL STUDIES

The purpose of the Center for Housing and Environmental Studies (formerly Housing Research Center) is to aid and guide basic research in the field of housing, to facilitate graduate study, and to route housing information among colleges and departments and between the University and sources of information off campus. A small central staff facilitates the initiation and conduct of projects.

The facilities of the Center for Housing and Environmental Studies are available to faculty members and graduate students in all fields. Through the Center, students who cut across traditional lines of research may draw upon the knowledge and experience of specialists in such various subject areas as design, materials, equipment, structural methods, environment, family living, economics and finance, government, and health.

The Director of the Center is Professor Glenn H. Beyer, Martha Van Rensselaer Hall, and the Assistant Director is Professor Alexander Kira, Sibley Hall.

CENTER FOR AERIAL PHOTOGRAPHIC STUDIES

Photographic interpretation has applications in the fields of agriculture, engineering, geology, and city and regional planning. The Center for Aerial Photographic Studies offers a broad program in various scientific fields for training personnel in aerial photographic interpretation. The objectives are, first, to train scientists who will be able to use aerial photographs for surveys and planning in fields where they are needed and, second, through research to extend the use of aerial photographs into all fields which can be benefited.

The Center comprises a staff of educators, scientists, and technicians experienced in research and the application of aerial photographs to their respective fields. The program consists of primary courses in engineering interpretation of aerial photographs, map reproduction, photogrammetry, cartography and map projections, together with specialized study in a particular field of the candidate's choice, such as agricultural development, national resource explorations, city planning, or engineering project planning.

For more information, write to the Director, Professor Ta Liang, Center for Aerial Photographic Studies, Hollister Hall.

MEDIEVAL AND RENAISSANCE STUDIES

The Program in Medieval and Renaissance Studies offers opportunities for work on topics, problems, or aspects of medieval and Renaissance civilizations more extensive than those usually treated within a single discipline or within the time limits conventionally observed in a major subject (as defined on p. 5). Plans of study therefore normally include:

1. Concentration in one field of instruction (see pp. 44 ff.), in which the student will become capable of independent work. The student will specify in his application that he wishes acceptance by this field, not by the program, although he should mention his interest in the program; and he will expect to complete all the stated requirements for a major in the field.

2. Related studies chosen from various disciplines. The members of the Special Committee (see p. 5) will advise the candidate less with the aim of making him highly proficient in their own specialties than of increasing his understanding of medieval and Renaissance civilization as a whole.

3. A thesis involving relations between various areas and periods, rather than matters customarily studied within the limits of any one of them.

In addition to fellowships and scholarships offered by the Graduate School to all students (see p. 17) and in addition to assistantships in some departments, the George Lincoln Burr Fellowship is available to candidates in the program (see p. 20). Applicants for it should mention it on the usual fellowship forms and should also send notice of having done so to the Chairman, Professor W. H. French, Interdepartmental Committee on Medieval and Renaissance Studies, Goldwin Smith Hall. Inquiries or requests for further information should be similarly addressed.

INTERNATIONAL STUDIES

CENTER FOR INTERNATIONAL STUDIES

The Center for International Studies supports and co-ordinates Cornell University's exceptional combination of resources for graduate study and research in contemporary international affairs. It serves to link together the activities of the specialized programs, to stimulate new research and development, and to advise and assist the University on contract commitments abroad sponsored by government or private agencies.

At Cornell the graduate student is offered substantial facilities for international studies in a wide variety of fields, including the physical and biological sciences. Active programs of instruction or research on the problems of foreign areas and international relations are found not only in the relevant social and humanistic studies, but also in such fields as agriculture, veterinary medicine, nutrition, engineering, regional planning, industrial and labor relations, business and public administration, education, home economics, law, and other fields. Cornell University is in a unique position to apply to international problems many diverse disciplines whose urgent relevance is too often disregarded.

The Center for International Studies, as such, does not have a separate faculty of its own nor does it offer courses of instruction. Instead, Center-sponsored projects and research activities, as well as the various programs and committees associated with the Center, draw on the participation of the University faculty. In addition, the Center brings to Cornell visiting faculty, postdoctoral research fellows, and distinguished academic and professional personnel in the area of international affairs.

Services to graduate students include provision of information regarding research activities in international studies both on and off campus, and the opportunity to participate in Center-sponsored faculty research projects. Among the latter are the Modernization Analysis Workshop, which studies the process of modernization in developing societies, and a faculty study group on problems of disarmament and arms control. Fellowships and assistantships in international studies may be obtained from the several relevant fields, or support may be secured through National Defense Education Act Fellowships or other sources outside Cornell. In addition, two predoctoral research fellowships in international studies are offered annually by the Graduate School upon the recommendation of the Center for International Studies.

The student interested in a particular foreign area or in particular inter-

national problems may find that the faculty of his own major discipline field includes specialists qualified to provide appropriate instruction or supervision. Or the student may wish to major or minor in one of the relevant functional fields of international studies recognized by the Graduate School, such as anthropology, comparative government, international relations, international law and organization, sociology, international and comparative labor relations, international economics and the economics of development, agricultural policy and economic development, international and foreign operations, and international legal studies. The student seeking a specialized knowledge of a foreign area may work in one of the three major interdisciplinary graduate areas and language programs on China, Southeast Asia, and Latin America, in all of which Cornell has outstanding facilities in staff, library, and other resources in a broad range of disciplines; or in the international agricultural development program; or under the guidance of faculty committees on Soviet, South Asian, African, or Near Eastern studies; or he may major or minor in history, linguistics, or a foreign literature.

The offices of the Center for International Studies are in Rand Hall. Further information may be obtained from Professor Steven Muller, Director, 205 Rand Hall.

SOUTHEAST ASIA PROGRAM

Faculty: J. M. Echols, F. H. Golay, R. B. Jones, Jr., G. McT. Kahin, L. Sharp. Visiting Faculty (1962–1963): D. G. E. Hall, O. W. Wolters, T. Yamamoto.

The Southeast Asia Program possesses substantial facilities for study and research on the graduate level and provides exceptional opportunities for general or specialized work on all of Southeast Asia in various fields of the humanities, social sciences, and some natural sciences, as well as in interdisciplinary area seminars. Much basic and pioneering research remains to be done in this area, and the Southeast Asia Program is organized and equipped to help meet such needs.

Several Southeast Asia Program fellowships and research assistantships are available to graduate students. These carry stipends of up to $2500, plus tuition and fees, and are available only to qualified candidates for an advanced degree at Cornell. Competition for these awards is open to citizens of the United States or Canada, nationals of Southeast Asian countries, and, in exceptional cases, nationals of other countries.

These awards are available to applicants who are able to demonstrate a serious scholarly interest in Southeast Asian studies; who show the greatest promise of becoming qualified regional experts with specialization in a relevant discipline of the humanities, social sciences, or certain natural sciences; and who are admitted to the Cornell Graduate School for advanced work in such a discipline. Previous experience in Southeast Asia or in the study of that area is not necessarily required. It is important that the applicant be able to show that advanced work in a major subject offered at Cornell, combined with work in the Southeast Asia Program, will make his future professional activities more effective; this requirement is particularly important for a student in the natural sciences.

Fellowship and assistantship appointments are made for one academic year, and reappointment is subject to reapplication and review. The primary purpose of these awards is to encourage graduate students to acquire a substantial knowledge of Southeast Asia while majoring in one of the discipline fields of the Graduate School. Accordingly, they are usually offered only to students who take a minor in Asian Studies and participate fully in the Southeast Asia Program. The recipient of a fellowship may be asked to devote up to six hours a week under faculty supervision to work connected with the Program.

London-Cornell University Fellowships are open to advanced Ph.D. candidates in the social sciences (including modern institutional history) who are in the Southeast Asia Program. They are tenable for study during an academic year at the London School of Economics and Political Science or at the School of Oriental and African Studies of the University of London. Stipends range from $2000 to $3000 plus air fares and tuition and fees.

London-Cornell Field Fellowships are open to Ph.D. candidates in the social sciences (including modern institutional history) who are minoring in Southeast Asian studies. They are tenable for 18 to 24 months for the purpose of dissertation research. London-Cornell Field Fellows may conduct their research in any part of East Asia where relevant materials are available. Stipends are up to $12,000 for two years, including travel and research expenses.

National Defense Foreign Language Fellowships and the Foreign Area Training Fellowships administered by the Social Science Research Council are also available. Graduate students may also apply for other assistantships, fellowships, and scholarships offered by the University and its departments.

Additional information on the Program and the various fellowships and awards may be obtained by writing to Professor George McT. Kahin, Director, Southeast Asia Program, Franklin Hall.

CHINA PROGRAM

Faculty: K. Biggerstaff, N. C. Bodman, C. F. Hockett, J. W. Lewis, T. C. Liu, R. M. Marsh, H. C. Mills, H. Shadick, G. W. Skinner, M. W. Young.

The China Program brings together ten China specialists, professors in the fields of anthropology, economics, government, history, history of art, language and literature, linguistics, social psychology, and sociology.

Graduate students in the Program take a major in one of the fields listed above. They are expected at an early stage to attain sufficient control of the Chinese language to permit use of Chinese sources in their courses and seminars and in their research.

The focus of much of the research and teaching in the Program is contemporary China, especially the society, polity, economy, culture, and arts of the People's Republic. Students with this concentration are also expected to develop a general knowledge of traditional institutions and culture. Students majoring in history concentrate on nineteenth- and twentieth-century China; those in literature or history of art normally concentrate on early modern or premodern China.

Several China Program fellowships and research assistantships are offered each year to graduate students who are citizens of the United States and Canada. In exceptional cases awards may be made to nationals of China. These awards

carry stipends of up to $2500 plus tuition and fees. London-Cornell University Fellowships are open to advanced Ph.D. candidates in the social sciences (including modern institutional history) who are in the China Program. They are tenable for study during an academic year at the London School of Economics and Political Science or at the School of Oriental and African Studies of the University of London. Stipends range from $2000 to $3000 plus air fares and tuition and fees.

London-Cornell Field Fellowships are open to Ph.D. candidates in the social sciences (including modern institutional history) who are in the China Program. They are tenable for 18 to 24 months for the purpose of dissertation research. London-Cornell Field Fellows may conduct their research in any part of East Asia where Chinese communities or materials on modern and contemporary China are accessible. Stipends are up to $12,000 for two years, including travel and research expenses.

National Defense Foreign Language Fellowships and the Foreign Area Training Fellowships administered by the Social Science Research Council are also available. Graduate students may also apply for other assistantships, fellowships, and scholarships offered by the University and by its departments.

Additional information on the Program and the various fellowships and awards may be obtained by writing to Professor Harold Shadick, Director, China Program, Franklin Hall.

LATIN AMERICAN PROGRAM

Faculty: D. Brenes, H. E. Conklin, T. Davis, B. L. Ellenbogen, R. K. Goldsen, R. Graham, A. R. Holmberg, H. A. Landsberger, D. F. Solá, J. M. Stycos, W. F. Whyte.

The Latin American Program of studies enables the graduate student to develop specialized competence in the history, culture, social organization, and language of Latin American countries. By means of a complex of courses drawn from various fields and under the guidance of Latin American specialists, the student majoring in a relevant discipline can minor in Latin American studies.

Because of the considerable volume of research on Latin America currently being carried out by Cornell faculty members, students will normally be afforded the opportunity of participating in on-going projects while in residence and will generally be expected to do field work in Latin America at some stage of their graduate training. A limited number of research assistantships and National Defense Education Act Fellowships are available each year.

Additional information may be obtained by writing to Professor J. M. Stycos, Director, Latin American Program, Morrill Hall.

INTERNATIONAL AGRICULTURAL DEVELOPMENT PROGRAM

Cornell University provides unusual scope and facilities for graduate-level study and research concerning development of the critical agricultural sector of newly developing nations. An integrated program of research and graduate training is available in the various physical, biological, and social science fields which are relevant to agricultural development. All fields of study in the New

York State College of Agriculture at Cornell University have faculty members with intensive foreign experience and students training for overseas work.

A student preparing for work in international agricultural development majors in a specific subject matter field. In addition to basic preparation in that field, he may follow courses which help him in applying subject matter knowledge to the special conditions of newly developing nations, consult with experienced faculty members in regard to such application, and pursue a research project for his dissertation which is relevant to the special problems of newly developing countries. In much of this work the program in agriculture draws upon the strong international programs in other colleges of the University, including the area study programs and the extraordinarily varied offerings in modern languages and linguistics.

Faculty experience in overseas work is continuously developed through work on College overseas programs, individual consulting assignments, and the ongoing research of faculty members and their students. The environment for the International Agricultural Development Program is further enhanced by more than 200 foreign graduate students majoring in the various fields represented by the College of Agriculture.

Substantial expansion has recently taken place in the international program of the three rural social science departments—agricultural economics, rural education, and rural sociology. In addition to nineteen regular faculty members with extensive overseas experience, several members of these departments devote themselves full time to research and teaching in international agricultural development; they have built special programs of research and continuing contact with particular geographic areas. The three departments have a number of assistantships designed to finance graduate students while they work closely with the teaching and research program in international agricultural development. Doctoral candidates in these departments who are interested in international agricultural development are expected to do field research in newly developing countries for their doctoral dissertations. Emphasis in field research lies largely in Latin America, Southeast Asia, and South Asia.

Similar expansion of international activities is under way in other subject matter areas of the College of Agriculture. At present, most departments in the College also have departmental assistantships which are open to outstanding students in those departments.

Additional information may be obtained by writing to the Director, International Agricultural Development Program, Roberts Hall, or to the Field Representative in a student's specific field of interest.

SOVIET STUDIES

Committee on Soviet Studies: GEORGE FISCHER, *Chairman;* URIE BRONFENBRENNER, M. GARDNER CLARK, GEORGE GIBIAN, RICHARD L. LEED, WALTER MCK. PINTNER.

A considerable number of courses and seminars on the Soviet Union and also Imperial Russia are offered by the University. They are taught by specialists on Russia in the fields of city planning, economics, government, history, linguistics, literature, and social psychology as well as the Russian language. Interested students may obtain advice or information from the Committee on Soviet Studies. The Committee can also provide a limited number of awards each

year to graduate students who assist faculty research in modernization—the general patterns of Russia's social, economic, and political development in the nineteenth and twentieth centuries. The Division of Modern Languages selects several graduate students each year as teaching assistants in the Russian language. Inquiries should be addressed to Professor George Fischer, Chairman, Committee on Soviet Studies, 312 West Sibley Hall.

SOUTH ASIAN STUDIES

Committee on South Asian Studies: M. E. OPLER, *Chairman;* ALLEN C. ATWELL, ARCHIE T. DOTSON, GORDON H. FAIRBANKS, JOHN W. MELLOR, MARTIE W. YOUNG.

The South Asia program is guided by a committee of faculty members from such fields as anthropology, agricultural economics, fine arts, government, and modern languages. Qualified graduate students with a minor in Asian Studies may elect a concentration in South Asian work. Fellowship and assistantship awards are available to students in the South Asia Program. National Defense Foreign Language Fellowships and Area Training Fellowships are also available. Opportunities exist for graduate students to become associated with Cornell-sponsored research undertakings in South Asia or to carry on independent research abroad. Additional information can be obtained by writing to Professor M. E. Opler, Chairman, Committee on South Asian Studies, 207 Morrill Hall.

AFRICAN STUDIES

Advisory Faculty Committee on African Studies: MILTON R. KONVITZ, *Chairman;* WILLIAM FRIEDLAND, CHARLES C. HUGHES, ALEXANDER LEIGHTON, CHANDLER MORSE, STEVEN MULLER.

Cornell University has substantial facilities for graduate study and research on Africa. Many members of the faculty in a variety of fields are qualified by research experience in Africa to provide instruction or guidance to students who wish to specialize in some aspect of African studies, who plan to work there, or who are interested in a general or comparative knowledge of the area. Instruction and training in general linguistics are available for students expecting to deal with tribal peoples; and special courses on particular African languages (e.g., Ibo, Yoruba) have been given in recent years. Courses are regularly offered on the native cultures of Africa and on the problems of economic, political, and social development of the area. The University libraries provide a good working collection of books, documents, and periodicals on Africa of sufficient scope to enable students and staff to carry on regional research. A representative group of African students is attracted to Cornell each year, most of whom are eager to discuss African life and problems with interested students from other areas.

Students wishing to relate the work of their major or minor fields to African area or language studies may benefit from the advice of the Faculty Committee on African Studies. Members of the Committee can provide suggestions regarding relevant courses in various fields, assistance in planning research on Africa, and guidance in applying for area training or research fellowships. Inquiries should be addressed to Professor Milton R. Konvitz, Chairman, Committee on African Studies, Ives Hall.

NEAR EASTERN STUDIES

Advisory Faculty Committee on Near Eastern Studies: J MILTON COWAN, *Chairman;* HENRY A. DETWEILER, ALFRED E. KAHN, STEPHEN A. MCCARTHY, ISAAC RABINOWITZ.

Students wishing to relate the work of their major or minor fields to Near Eastern area or language studies should seek advice or information from the Faculty Committee on Near Eastern Studies. In a number of fields, the University's resources for specialized graduate study and research on countries of the Near East are of considerable value. Members of the Committee can provide suggestions regarding relevant courses in various fields, assistance in planning research on the Near East, and guidance in applying for area training or research fellowships. Inquiries should be addressed to Professor J Milton Cowan, Chairman, Division of Modern Languages, Morrill Hall.

INTERNATIONAL LEGAL STUDIES

Please see the current *Announcement of the Law School.*

NEW YORK STATE AGRICULTURAL EXPERIMENT STATION AT GENEVA

The New York State Agricultural Experiment Station was established in 1880 to promote agriculture through scientific investigations and experimentation. It is located at Geneva, 50 miles from Ithaca, and has been under the administration of Cornell University since 1923.

Professors on the Geneva staff are eligible to serve as members of the special committees of graduate students along with professors on the Ithaca campus of the University. Normally the graduate training provided at Geneva consists of research experience and the supervision of the student's work on a thesis problem. The formal course work part of the student's training program is given on the Ithaca campus.

The Station is equipped to care for graduate students in certain specific lines of research, viz., bacteriology, chemistry, economic entomology, food technology, plant pathology, pomology, seed investigations, and vegetable crops. Ample facilities are available for graduate research under laboratory, greenhouse, pilot plant, insectary, orchard, and other field conditions.

Certain phases of the investigations now being conducted at the Station and other problems for which the facilities of the Station are suitable may be used as thesis problems by graduate students.

The Director is Professor D. W. Barton, who may be addressed at the New York State Agricultural Experiment Station, Geneva.

Students who plan to do part of their graduate work at Geneva should correspond with their major adviser or with the Dean of the Graduate School, concerning regulations as to residence, Special Committees, etc.

CORNELL AERONAUTICAL LABORATORY

The Laboratory, a separate corporation wholly owned by Cornell University, is in Buffalo, New York. Applied and fundamental research in the aeronautical

sciences and allied areas is conducted in this completely equipped laboratory under contracts mainly with the military services. Close relationships, both research and educational, are maintained with the campus in Ithaca.

OTHER RESEARCH UNITS

Some other research units allied with the University, either as wholly owned and operated divisions or as wholly or partially autonomous organizations with which the University has a working agreement, are the Sloan-Kettering Cancer Research Institute (in New York City, through the Graduate School of Medical Sciences), the Veterinary Virus Research Institute (at Ithaca), and the Brookhaven National Laboratory (Cornell is one of nine university trustees under contract with the Atomic Energy Commission).

In addition, opportunities for formal study, field work, and independent research by Cornell graduate students are available in many institutions, laboratories, and libraries, both in the United States and in other countries. For example, the Cornell-Harvard Archaeological Exploration at Sardis, Turkey, and the Museum of Northern Arizona at Flagstaff, Arizona, both provide opportunities for field research related to doctoral work of Cornell graduate students. Information on this kind of arrangement is available directly from the fields of study.

THE UNIVERSITY LIBRARIES

The University libraries comprise the central University Library (the John M. Olin Library and the Undergraduate Library); the Mann Library of Agriculture and Home Economics; the libraries of the following colleges and schools: Business and Public Administration, Engineering, Fine Arts, Hotel, Industrial and Labor Relations, Law, Medicine (New York City), and Veterinary; such special libraries as the Barnes Library in Anabel Taylor Hall (religion) and the libraries of the Cornell Aeronautical Laboratory and the Geneva Experiment Station; as well as a group of special departmental libraries. The total holdings of the libraries exceed 2,400,000 items, and about 75,000 volumes are being added annually.

The new John M. Olin Library, completed in 1961, was the first phase of a two-part program which has given the Cornell University community a central library housed in adjacent buildings. The Olin Library is designed primarily as a research library to serve graduate students and members of the faculty. In the second phase of the program, the former University Library building (at the Clock Tower) has been remodeled to serve undergraduate students. The Undergraduate Library reopened in September, 1962.

Three of the campus libraries—Engineering, Veterinary, and Industrial and Labor Relations—recently moved into spacious and attractive new quarters in Carpenter Hall, Schurman Hall, and Ives Hall respectively. These libraries now contain ample space for the growth of their collections and convenient and comfortable accommodations for readers.

The libraries not only provide the reference and collateral reading materials necessary for the support and enrichment of teaching and research but also have extensive collections of rare books, newspapers, maps, documents, manuscripts, microfilms, and microcards. Especially enriched by the early acquisitions of Cornell's first president, Andrew D. White, and by the first librarian, Willard

Fiske, the libraries possess special collections of rare books and manuscripts in many of the fields of graduate study, including unique collections relating to the French Revolution, witchcraft, Dante, Petrarch, China and Southeast Asia (Wason), Iceland, American historical documents (Noyes), Brazil, German literature and philology (Zarncke), Wordsworth, and Joyce. There is a separate rare book department with a curator in charge. The acquisitions and reference librarians work with graduate students to procure volumes needed for their special studies. Cubicles and other study rooms are available for the use of graduate students in the several libraries.

The Collection of Regional History and the Cornell University Archives constitute a manuscript depository which is expanding at the rate of half a million manuscripts a year. In 1962 the holdings totaled approximately fourteen million items. These manuscripts relate to all aspects of the economic, political, and social history of this region and areas connected historically with it, and to all aspects of the development of Cornell University. The curator and archivist attempt to acquire manuscripts for special projects or researchers.

PUBLICATION AND PHOTOGRAPHY

Cornell University Press is the oldest university press in America and is among the leaders in number of volumes published annually. The purpose of the Press is to serve the interests of scholars in the academic world.

The extension services of the New York State Colleges, which form integral parts of the University, disseminate knowledge through an intensive program of publication, photography, and recording, supervised by professional staffs. Materials of graduate students may find an outlet through these channels.

The University owns and operates the Photo Science Studios, which are equipped to create or cooperate in the creation of photographic studies and visual aids of all kinds.

FIELDS OF INSTRUCTION

THE FIELDS OF INSTRUCTION in the Graduate School are listed alphabetically below under the following four Areas: Humanities, Social Sciences, Biological Sciences, and Physical Sciences. For each of the *fields* there are listed the respective faculties, approved major and minor subjects, language requirements for the Master's degree (if any), and special requirements or policies of the *field.*

FIELDS

In most instances the *field* coincides with a department in a college or school at Cornell. In parentheses immediately following the name of the *field* is given an abbreviation indicating the Announcement (catalog) * of the school or college which contains descriptions of courses and seminars offered, as follows: *Ag.,* New York State College of Agriculture; *Arch.,* College of Architecture; *Arts,* College of Arts and Sciences; *Ed.,* School of Education; *H.E.,* New York State College of Home Economics; *Hotel,* School of Hotel Administration; *I.L.R.,* New York State School of Industrial and Labor Relations; *Vet.,* New York State Veterinary College. Because the College of Engineering *(Engin.)* has two Announcements, prospective graduate students should specify their interest in graduate work and should request the particular engineering Announcement entitled *Engineering Courses and Curricula.*

For registration and preregistration in courses, see p. 9.

MAJOR AND MINOR SUBJECTS

For each *field* there is given an approved list of titles from which candidates for advanced general degrees choose major and minor subjects. The numbers 1, 2, 3, 4, 5 have the following meaning:

1, approved as major subject for the Ph.D.
2, approved as major subject for the Master's degree.
3, approved as minor subject when the major is in the same *field.*
4, approved as minor subject when the major is in another *field.*
5, approved as a minor subject for the Master's degree only.

For explanation regarding *language requirements* for the Master's degree, see p. 9.

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*Announcements of the schools and colleges of Cornell are listed on the inside back cover. They may be obtained by writing the Announcements Office or the Graduate School Office, Day Hall.

REPRESENTATIVES

Since instruction in the Graduate School is primarily individual, those interested in becoming students are encouraged to communicate with individual members of the faculty with whom they may want to study. Personal interviews in advance of formal application for admission are especially encouraged. For the benefit of those who are not acquainted with appropriate members in the *field* or *fields* of their choice, each *field* has selected a *representative* to whom inquiries may be addressed.

In corresponding with a field representative, please indicate the title *Graduate Field Representative* on the envelope address.

HUMANITIES

ARCHITECTURE *(ARCH.)*

Faculty: L. D. Brown, T. H. Canfield, A. H. Detweiler, S. W. Jacobs, B. G. Jones, F. M. Wells.

APPROVED MAJOR AND MINOR SUBJECT

Architectural History 1, 2, 3, 4
Architectural Structure 2, 3, 4

Language requirement for the Master's degree in architectural history: proficiency in French, German, or Russian before completion of second residence unit.

Admission to graduate work in architectural history is normally limited to students whose undergraduate programs emphasized history of art, architecture, or related subjects. Work is conducted by seminar and other courses in this and related departments in combination with independent study under individual direction. The Fine Arts Library provides a focus and resources for study and preparation of the required thesis. Opportunities are usually available for qualified students to develop their skills in related activities, e.g., the Cornell-Harvard Archaeological Expedition to Sardis, Turkey.

A limited number of teaching assistantships are available in the College of Architecture.

ART *(ARCH.)*

Faculty: A. C. Atwell, V. Colby, N. D. Daly, K. Evett, J. M. Hanson, J. A. Hartell, H. P. Kahn, J. O. Mahoney, J. L. Squier.

APPROVED MAJOR AND MINOR SUBJECTS

Painting 4
Sculpture 4

HISTORY OF ART AND ARCHAEOLOGY *(ARTS)*

Faculty: N. A. Pattillo, A. S. Roe, W. Smith, A. R. Solomon, J. H. Turnure, F. O. Waage, M. W. Young.

APPROVED MAJOR AND MINOR SUBJECTS

Ancient Art and Archaeology 1, 2, 3, 4
Medieval Art 2, 3, 4
Renaissance and Baroque Art 1, 2, 3, 4
Modern Art 1, 2, 3, 4
American Art 1, 2, 3, 4
Oriental Art 1, 2, 3, 4

Language requirement for the Master's degree, proficiency in one: French, German, or Italian, to be demonstrated at least one term before the degree is awarded.

Graduate work in the history of the visual arts (architecture, painting, sculpture, and the minor arts) and in archaeology is offered through a combination of courses and independent study and research under individual direction. A candidate for the Master's degree in archaeology may substitute relevant courses in such subjects as cultural anthropology for some of those in art history; and the candidate in classical archaeology may substitute courses in Latin and Greek.

A half-time assistantship is available. Prospective students interested in applying for this should write directly to the Department of the History of Art, Goldwin Smith Hall.

CHINESE LITERATURE *(ARTS)*

(See ASIAN STUDIES)

CITY AND REGIONAL PLANNING *(ARCH.)*

Faculty: G. H. BEYER, F. W. EDMONDSON, A. G. FELDT, J. C. FISHER, B. G. JONES, B. KELLY, T. W. MACKESEY, K. C. PARSONS, J. W. REPS.

APPROVED MAJOR AND MINOR SUBJECTS

City Planning 1, 3, 4 — Regional Planning 1, 3, 4

Major study for candidates for the degree of Ph.D. is limited to those who hold the degree of Master of Regional Planning or its equivalent.

A detailed description of the requirements and curriculum for the professional Master's degree, Master of Regional Planning, will be found in the *Announcement of the College of Architecture.*

For admission to candidacy for the Ph.D. degree with a major in the field of city planning or regional planning, a Master's degree in City or Regional Planning with course work equivalent to that required in the program at Cornell is ordinarily required. Candidates who lack the equivalent of this training or who hold the Master's degree in a related field and have had acceptable experience in city or regional planning practice or research may be required to take additional course work at the Master's level.

Candidates for the Ph.D. degree proposing to major in this field must select a major subject from the two listed above. It is the policy of the field to encourage selection of both minor subjects from related subjects outside the field. Prospective students should therefore consult the descriptions in this Announcement of other subjects such as administrative engineering, aerial photographic studies, agricultural economics, architectural history, comparative government, econometrics and economics statistics, economic development, economic theory, housing and design, law, natural resources conservation, operations research, the political process, political theory, public administration, research methodology, sociology, statistics, sanitary engineering, and transportation engineering.

Since work for the Ph.D. is considered preparatory to making creative contributions to the field, substantial competence and knowledge of basic analytical and research methods will be required. Candidates may fulfill this requirement by preparation previous to entrance or by course work at Cornell which may be in a minor field. Candidates for the Ph.D. degree are expected to present a thesis of either a theoretical or applied nature.

Requirements for a minor subject in the field while less rigorous than a major presume a suitable preparation for advanced work.

The Department of City and Regional Planning conducts a program of research in urban studies in cooperation with the Center for Housing and Environmental Studies which offers opportunities for participation of graduate students.

In addition to the fellowships available through the Graduate School, the College of Architecture appoints a number of Master's and doctoral candidates to part-time teaching and research positions. Prospective students interested in applying for assistantships should write to the Dean of the College of Architecture.

THE CLASSICS *(ARTS)*

Faculty: H. Caplan, J. Hutton, G. M. Kirkwood, F. O. Waage, D. Wiesen.

APPROVED MAJOR AND MINOR SUBJECTS

Latin 1, 2, 3, 4
Medieval and Renaissance Latin Literature 1, 2, 3, 4
Ancient History (see p. 59)
Comparative Indo-European Linguistics 3, 4
Greek 1, 2, 3, 4
Classical Archaeology 2, 3, 4
Classical Rhetoric in Original or Translation 3, 4
Ancient Thought 3, 4

Language requirement for Master's degree, proficiency in one: French or German, to be demonstrated at least one term before the degree is awarded.

Admission to graduate study in a subject included in the Field of the Classics, except in archaeology, assumes a knowledge of the field selected equivalent in general to that expected of a student who has pursued the subject concerned throughout four years of undergraduate study in a college of recognized standing.

Graduate work in the Classics is conducted in the main by the seminar system, the object of which is training in the methods, the principles, and the performance of independent research and criticism, and the work is therefore as far as possible put into the hands of the students themselves. A seminar room in the University Library building is reserved for the exclusive use of graduate students in the Classics.

For fellowships in Greek and Latin, (see p. 20). The income of the Charles Edwin Bennett Fund for Research in the Classical Languages is used each year in the way best suited to promote the object for which the fund was established.

Applicants are advised to submit Graduate Record Examination Aptitude Test scores.

Doctoral dissertations of an appropriate nature will be accepted for publication in the *Cornell Studies in Classical Philology*.

COMPARATIVE LITERATURE *(ARTS)*

Faculty: R. M. Adams, E. A. Blackall, D. Brenes, H. Caplan, A. Caputi, P. de Man, J.-J. Demorest, R. Durling, E. G. Fogel, D. Grossvogel, G. Gibian, J. Hutton, W. R. Keast, G. M. Kirkwood, G. A. McCalmon, B. Pike, I. Rabinowitz, H. Shadick.

APPROVED MAJOR SUBJECT

Comparative Literature 1

No Master's degree is offered in comparative literature. Candidates who wish to pursue work for the Ph.D. in comparative literature are advised to take a regular M.A. in the national literature which interests them most. A candidate's work for the M.A., if concerned with a modern literature, should involve some study of medieval, Greek, or Latin literature. Each candidate's two minor subjects are to involve *two* national literatures, other than that of his major subject for the M.A., and are to be chosen from among the subjects already approved as minor subjects under the various literary fields. There is only one restriction: no candidate may include *both* English and American literature among his subjects for the Ph.D.

Candidates for the Ph.D. with a major in comparative literature are expected to demonstrate an adequate reading knowledge of Latin or Greek.

ENGLISH LANGUAGE AND LITERATURE *(ARTS)*

Faculty: M. H. Abrams, R. M. Adams, J. P. Bishop, J. F. Blackall, A. J. Caputi, G. F. Cronkhite, R. M. Durling, C. R. Edwards, R. H. Elias, S. B. Elledge, E. G. Fogel, W. H. French, R. A. Greenberg, B. L. Hathaway, G. H. Healy, A. Kaminsky, W. R. Keast, J. R. McConkey, F. E. Mineka, A. M. Mizener, D. Novarr, S. M. Parrish, F. G. Read, W. M. Sale, W. J. Slatoff, H. H. Smith, T. W. Stoehr, H. Vendler, J. M. Wallace.

APPROVED MAJOR AND MINOR SUBJECTS

Medieval Literature 1, 2, 3, 4
Old and Middle English 1, 2, 3, 4
The English Renaissance to 1660 1, 2, 3, 4
The Restoration and Eighteenth Century 1, 2, 3, 4
The Nineteenth Century 1, 2, 3, 4
The Nineteenth and Twentieth Centuries 1, 2, 3, 4
American Literature 1, 2, 3, 4
English Poetry 1, 2, 3, 4
Dramatic Literature 1, 2, 3, 4
Prose Fiction 1, 2, 3, 4
Creative Writing 2, 3, 4
English Literature 2, 3, 4
English and American Literature 2, 3, 4
Bibliography 3, 4

Among his major and minor subjects no candidate may include both of these subjects: the Nineteenth Century, and the Nineteenth and Twentieth Centuries.

Language requirement for Master's degree, proficiency in one: Greek, Latin, French, German, Italian. Candidates failing to demonstrate proficiency on admission will be required to complete two residence units following passing of the examination, unless an exception is made by the field.

Language requirement for the doctorate: proficiency in French and German. The first language must be passed before the qualifying examination may be scheduled; the second language, before examination A may be scheduled. Before receiving the degree, candidates for the doctorate must have a knowledge of Old English, both the language and the literature. Besides the required languages, Latin is particularly recommended for all students, and Italian for those majoring in the Renaissance.

The field requires applicants to submit scores of the Graduate Record Examination (Aptitude and Advanced Tests) though in special circumstances the requirement may be waived.

Applicants who have had no prior graduate study may apply for direct admission to the doctoral program. Those with superior qualifications will be admitted as provisional candidates; others may be invited to re-apply for the Master's degree. Later admission to the doctoral program can be assured by a distinguished record at the Master's level.

Every student should note the relatively few requirements imposed by the Graduate School and the field; but apart from satisfying these, he may exercise a wide choice in making up his program. He may strengthen weak areas in his preparation or explore in depth areas with which he has some familiarity; he may take training in criticism, in literary history, in philology, in scholarship, in creative writing. The candidate for the Master's degree is not expected to specialize (though he may if he chooses); hence, he normally selects a general major subject, such as English literature, or English and American literature. At the doctoral level any reasonable arrangement of major and minor subjects is possible, within the limits indicated. Most students majoring in English also minor in English, but minors in other literatures, classics, history, philosophy, linguistics, or speech and drama are equally acceptable.

During their first year in residence all students will complete eight one-term courses, at least four of them numbered 500 or above in the *Announcement of the College of Arts and Sciences*. For the Master's candidate, one of the eight courses will be a thesis course, with the Chairman of his Special Committee in charge. Beyond the first year of study (and for doctoral candidates who have completed a year of graduate study elsewhere), the field imposes no course requirements, though it is customary to take work in Old English and in bibliography.

Candidates for the Master's degree who expect to complete their work entirely in summer sessions will take two courses in each of their first four summers, and then in the fifth summer register for the thesis course.

In addition to receiving its share of the fellowships made available by the Graduate School, the field controls the award of the Martin Sampson and the Class of 1916 Fellowships, and appoints a number of doctoral candidates to part-time teaching positions. Address inquiries about teaching positions to the Chairman, Department of English, Goldwin Smith Hall. Address inquiries about graduate work to the Field Representative, Department of English, Goldwin Smith Hall.

GERMAN *(ARTS)*

Faculty: E. A. Blackall, A. Bonawitz, P. de Man, O. J. M. Jolles, H. L. Kufner, B. E. Pike.

APPROVED MAJOR AND MINOR SUBJECTS

German Literature 1, 2, 3, 4 Germanic Linguistics 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in German or French or Russian as soon as possible and no later than the beginning of the second semester of residence.

In the advanced courses in this field the work is twofold: literary and linguistic. The history of German literature from the earliest period to the present day is treated in lecture courses with collateral reading. Special topics are selected for detailed study in the seminar on Germanic linguistics and the seminar in German literature. The courses offered in Germanic linguistics include the study of Gothic, Old Saxon, and Old and Middle High German; they also afford an introduction to the methods of descriptive, historical, and comparative linguistics as applied to Germanic languages, dialectology, and the history of the German language from earliest times. The course on bibliography and method aims to impart the principles and methods of investigation and a knowledge of the bibliographical resources.

Candidates for the Ph.D. with a major in German literature must select Germanic linguistics as one of their minors; candidates for the Ph.D. with a major in Germanic linguistics must select German literature as one of their minors. Candidates for the Ph.D. in German are expected to have an adequate knowledge of French and Latin, and must pass the Graduate Reading Examination in French as one of the languages offered.

For further details of graduate work in German, see the *Guide for Graduate Students in German at Cornell University,* available from the Chairman of the Department of German Literature.

MUSIC *(ARTS)*

Faculty: W. W. Austin, W. A. Campbell, D. R. Eller, D. J. Grout, K. Husa, J. Kirkpatrick, R. M. Palmer, T. A. Sokol.

APPROVED MAJOR AND MINOR SUBJECTS

Musical Composition 2, 3, 4 Theory of Music 2, 3, 4
Musicology 1, 2, 3, 4

Language requirement for Master's degree: for majors in musicology, proficiency in French and German; for majors in composition or theory, proficiency in French or German. Proficiency must be met immediately upon admission to candidacy.

Candidates are expected to take active interest in musical performance. All candidates are tested for musical proficiency: singing and playing unfamiliar music at sight, score reading, and fluency at the keyboard; on the basis of these tests, students may be advised to enroll in undergraduate courses or to undertake extracurricular work in musical practice and theory. Choral and orchestral organizations of the University and the community welcome graduate students and their wives or husbands as members.

Normally, students whose major subject is theory or composition choose musicology as a minor subject, and vice versa. Doctoral candidates choose a second minor subject in a related field. It is especially important for doctoral candidates to equip themselves with a good reading knowledge of both French and German as early as possible.

A large microfilm collection of Renaissance music and music theory is available to qualified candidates working in this field.

Applicants for admission in music are required to submit scores for the Graduate Record Examination Aptitude Test.

SUSAN LINN SAGE SCHOOL OF PHILOSOPHY *(ARTS)*

Faculty: M. Black, S. M. Brown, Jr., J. V. Canfield, K. S. Donnellan, N. Malcolm, N. C. Pike, S. S. Shoemaker, F. N. Sibley, Z. Vendler.

The Susan Linn Sage School of Philosophy was founded through the generosity of the late Henry W. Sage, who endowed the Susan Linn Sage Professorship and gave in addition $200,000 to provide permanently for instruction and research in philosophy.

The Philosophical Review, supported by the University and managed by the Sage School, is an international quarterly that publishes articles, reviews, and discussions in all branches of philosophy.

APPROVED MAJOR AND MINOR SUBJECTS

Aesthetics 1, 2, 3, 4
Epistemology 1, 2, 3, 4
Ethics 1, 2, 3, 4
History of Philosophy 1, 2, 3, 4
Logic 1, 2, 3, 4
Metaphysics 1, 2, 3, 4
Philosophy 4
Philosophy of Religion 1, 2, 3, 4
Philosophy of Science 1, 2, 3, 4
Political Philosophy 3, 4

Language requirement for Master's degree: proficiency in French or German immediately upon admission to candidacy.

The instruction offered to graduate students presupposes such undergraduate courses in the subject as would be taken by a student in the College of Arts and Sciences of Cornell University who had elected philosophy as a major subject. Those who have not had equivalent preparation are expected to make up their deficiencies outside the work required for an advanced degree.

The Sage School provides opportunity for advanced study to two classes of graduate students: (1) those whose major interest is in some branch of philosophy; (2) those whose chief branch of research is in allied fields but who desire to supplement this with a minor in philosophy.

1. Students whose major interest is in philosophy are required (a) to gain a general knowledge of the whole subject including its history, and (b) to select some aspect or subdivision of it for intensive study and research.

2. Graduate students having a major interest in literature of the arts, in history or social studies, or in mathematics or a branch of experimental science, are permitted to choose a minor in philosophy with such emphasis as best suits their needs. For such students the School endeavors to outline a plan of philosophical study (in courses or directed reading) which will form a natural supplement to their field of research.

The aim of the department in graduate work is to devote its resources primarily to the instruction of students who expect to proceed to the Ph.D. in philosophy. It is not the normal policy of the department to accept as graduate students those who have no intention of pursuing academic work beyond the M.A. degree. However, the department will be prepared to accept as M.A. candidates those students who expect to continue advanced studies later, either in philosophy or in some other field, and those who, while not expecting to pursue graduate work beyond the M.A., nevertheless give satisfactory evidence of a serious interest in philosophy.

ROMANCE STUDIES *(ARTS)*

Faculty: F. B. Agard, D. Brenes, A. M. Colby, P. de Man, J.-J. Demorest, R. M. Durling, D. I. Grossvogel, R. A. Hall, Jr., C. S. Leonard, Jr., E. P. Morris, J. Parrish, B. L. Rideout, A. Seznec, D. Solá.

APPROVED MAJOR AND MINOR SUBJECTS

French Linguistics 1, 2, 3, 4
French Literature 1, 2, 3, 4
Italian Literature 1, 2, 3, 4
Italian Linguistics 1, 2, 3, 4
Romance Linguistics 1, 2, 3, 4
Spanish Linguistics 1, 2, 3, 4
Spanish Literature 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French.

In the field of Romance Studies the student may concentrate either in linguistics or in literature.

Romance Linguistics. In Romance linguistics, the student is given training in four types of study and research: (1) general principles of linguistic analysis; (2) the description of the structure of the Romance language of his major interest; (3) the history, external and internal, of that language; and (4) the genetic and typological relationships of the Romance family of languages. Special emphasis is laid on the relation between linguistic history and cultural factors (literary, political, and social). A concomitant aim of this area is to afford practice in the application of linguistics to the teaching of one or more Romance languages.

Candidates in Romance linguistics may choose as their major subject either the linguistics (descriptive and historical) of a specific Romance language, or the comparative study of the Romance languages. Such candidates will normally have, as one of their minor subjects, the literature of the language in which their major interest lies. A prior knowledge of Latin is desirable; a candidate without prior knowledge of Latin will be expected to acquire a working acquaintance with its linguistic structure and history. Each candidate's program will be determined in individual consultation with his committee.

ROMANCE LITERATURE. Graduate studies in Romance literature are designed to train students as scholars and teachers of language and literature. The incoming graduate student is expected to possess an adequate command of the language of his specialization and to be endowed with the basic critical faculties and the intellectual curiosity required for scholarship and teaching. The department puts equal stress on language proficiency (oral and written), on historical knowledge, and on the critical interpretation of literary texts. It offers seminars in the main periods and figures of French, Italian, and Spanish literature, as well as advanced courses in various critical topics. Whenever possible, Ph.D. candidates will be given the opportunity to teach as part of their training.

The Master's candidate will ordinarily take six one-term courses in the major and two one-term courses in the minor. Of the courses taken in the major, at least one must be at the 400-level or above.

The candidate will write a Master's essay in the language of his major field.

The doctoral candidate will choose a major in a Romance literature. His first minor will be taken in a classical literature, in Romance linguistics or his major language, or in a second Romance literature. The second minor can be chosen in any field related to the major.

The Ph.D. candidate is ordinarily expected to take eight one-term courses in the major, two one-term courses in the history of the language of the major, three one-term courses in each of the minors. At least twelve of these courses should be at the 400-level or above. Work for the M.A. may be counted toward the requirement for the Ph.D.

Candidates must have fulfilled the Graduate School's language requirements in French and German and have demonstrated a reading knowledge of Latin in order to be allowed to take the A examination. The incoming graduate student will be asked to take an examination to ascertain his command of the language of his major subject.

Applicants are requested to take the Graduate Record Examination (Aptitude and Advanced Tests).

RUSSIAN *(ARTS)*

Faculty: G. H. FAIRBANKS, G. GIBIAN, R. L. LEED, M. SAMILOV.

APPROVED MAJOR AND MINOR SUBJECTS

Russian Literature 1, 2, 3, 4

Slavic Linguistics 1, 2, 3, 4

Course offerings in Slavic linguistics include Old Bulgarian and Old Russian; they also include courses in descriptive, historical, and comparative methods of analysis applied to the Slavic languages. Candidates for advanced degrees with a major in Slavic linguistics should have a reading knowledge of both French and German; candidates for the Ph.D. with a major in Slavic linguistics are expected to develop proficiency in a second Slavic language.

Course offerings in Russian literature include graduate seminars and 400-level courses in various genres of pre-1917 and post-1917 Russian literature. Emphasis is placed on critical interpretation of literary texts and the relationship of literature to Russian history and thought. The program aims at training scholars and teachers in the fields of Russian literature and culture. M.A. and Ph.D. candidates with a major in Russian literature are encouraged to choose minor subjects in Russian history, government, Slavic linguistics, or in a western European literature.

SPEECH AND DRAMA *(ARTS)*

Faculty: H. D. ALBRIGHT, C. C. ARNOLD, G. J. CANTER, H. CAPLAN, J. GOLDEN, G. A. MCCALMON, E. C. NUTTALL, T. M. SCHEIDEL, W. H. STAINTON, J. F. WILSON.

APPROVED MAJOR AND MINOR SUBJECTS

Division of Rhetoric and Public Address:
Rhetoric and Public Address 1, 2, 3, 4
Principles of Public Address 3, 4
Experimental Study of Oral Discourse 3, 4

Division of Dramatic Production:
Drama and Theatre 1
Dramatic Production 2, 3, 4

Division of Speech Behavior and Pathology
Speech Pathology 1, 2, 3, 4
Speech Behavior 1
See also General Linguistics *(Arts)*

The chief aim of graduate work in speech and drama is to develop competent investigators and teachers. In many cases, the work will require more than the minimum periods of residence. Ordinarily, residence in this University during at least two academic years will be necessary for the doctorate.

Applicants for graduate study in the Field of Speech and Drama must take the Graduate Record Examination Aptitude Test in sufficient time to permit consideration of the results along with the application for admission to the Graduate School.

Candidates for the Master's degree in the Division of Dramatic Production are required to complete at least one academic year and one summer session in residence.

Candidates for the Doctor's degree in the Division of Rhetoric and Public Address will usually choose one minor subject in a field concerned with literary history and criticism or with the social sciences.

In the Division of Dramatic Production candidates for the Doctor's degree will be required to take dramatic literature as a minor subject, unless they have already pursued systematic study of this subject. If preparing for general teaching, candidates will be advised to take additional courses in rhetoric and public address and in speech behavior and pathology. Candidates for the doctorate in this Division must expect to be in residence two years and one summer beyond the requirements for the Master's degree.

Students in the Division of Dramatic Production will be expected to avail themselves of the opportunities for theatre practice afforded by various branches of the Cornell University Theatre.

A fuller description of the graduate programs in speech and drama may be obtained by writing to the Field Representative, Department of Speech and Drama.

SOCIAL SCIENCES

AGRICULTURAL ECONOMICS *(AG.)*

Faculty: R. D. Aplin, R. Barker, C. P. Baumel, C. A. Bratton, M. E. Brunk, K. S. Carpenter, H. E. Conklin, L. C. Cunningham, L. B. Darrah, B. A. Dominick, W. G. Earle, D. C. Goodrich, G. W. Hedlund, R. B. How, C. D. Kearl, C. W. Loomis, E. A. Lutz, N. C. M. Luykx, J. W. Mellor, K. L. Robinson, R S. Smith, L. Spencer, B. F. Stanton, R. P. Story, W. G. Tomek, S. W. Warren.

APPROVED MAJOR AND MINOR SUBJECTS

Agricultural Economics 4
Agricultural Policy and Economic Development 1, 2, 3, 4
Farm Management 1, 2, 3, 4
Prices and Statistics 1, 2, 3, 4
Marketing and Business Management 1, 2, 3, 4
Public Administration and Finance 1, 2, 3, 4

The field offers opportunities for study and research in the following specialized branches: farm management, farm finance, marketing, food distribution, prices, statistics, business management, public administration and finance, agricultural land economics, agricultural geography, agricultural development, and agricultural policy.

Students majoring in this field are encouraged to take courses in related fields such as economics, statistics, and mathematics. Candidates for the Ph.D. degree are expected to select at least one minor in another field. Courses in related fields are listed in the *Announcements of the College of Arts and Sciences, of the Graduate School of Business and Public Administration, and of the School of Industrial and Labor Relations.*

Assistantships are available that provide an opportunity for part-time employment in teaching, research, or extension. Assistants normally conduct their thesis research as part of their assistantship duties in connection with departmentally financed projects.

A broad knowledge of the physical and biological aspects of agriculture is valuable background for graduate work in the Field of Agricultural Economics, but an undergraduate major in agricultural economics is not required.

Applicants are urged to take the Graduate Record Examination Aptitude Test and to submit the results with their application.

ANTHROPOLOGY *(ARTS)*

Faculty: R. Ascher, C. F. Hockett, A. R. Holmberg, W. W. Lambert, A. H. Leighton, M. E. Opler, P. J. Pelto, J. M. Roberts, L. Sharp, G. W. Skinner, R. J. Smith.

APPROVED MAJOR AND MINOR SUBJECTS

General Anthropology 1, 2
Archaeology 2, 3, 4
Physical Anthropology 3, 4
Social Anthropology 4
Applied Anthropology 4

Language requirement for the M.A. degree: college entrance language or proficiency in one language acceptable to the Special Committee.

1. All applicants resident in the United States during the year preceding matriculation at Cornell must submit the scores of the Graduate Record Examination Aptitude Test with their other credentials.

2. The graduate program for the Ph.D. in the Field of Anthropology is devoted to the development of creative scholars prepared for independent research and responsible teaching in anthropology. To this end each Ph.D. candidate is expected to command a knowledge of (1) the fundamentals of the subfields of anthropology (i.e., ethnology, archeology, linguistics, and physical anthropology) and their interrelations, (2) anthropological theory, (3) methods and techniques of research, (4) the anthropology of one major culture area of the world, and (5) the general characteristics of the other major culture areas of the world.

3. The Ph.D. candidate with major concentration in general anthropology, in consultation with the Chairman of his Special Committee, selects two minors which, in combination with the major, form a unitary program of study. He may not, however, select social anthropology or applied anthropology as minor subjects. For the student whose major is outside the Field of Anthropology, minors in archeology, physical anthropology, and applied anthropology are approved for the Ph.D. only.

4. Although the Field of Anthropology strongly recommends that candidates seeking a career in anthropology elect the Ph.D. program, M.A. majors are occasionally accepted. The candidate for the Master's degree with major concentration in general anthropology is expected to command a knowledge of (1) the fundamentals of ethnology (social anthropology) and of two other subfields of anthropology, (2) anthropological theory, and (3) the anthropology of one major culture area of the world. The candidate for the M.A. in the Field of Anthropology selects one minor, with the approval of his Committee Chairman, in any field in the Graduate School. The Field of Anthropology also provides opportunity for study toward the M.A. with major concentration in archeology.

5. The language requirement for the Ph.D. candidate with major concentration in general anthropology is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four groups: (1) Russian, (2) German, Dutch, (3) French, Italian, Spanish, Portuguese, and (4) Burmese, Chinese, Hindi, Indonesian, Japanese, Thai. The candidate may petition the Graduate School for other languages as well.

6. Students majoring in anthropology or electing a minor under the Field of Anthropology, have the opportunity to participate in research conducted by the staff. For additional information on staff research, details of the majors and minors administered by the Field of Anthropology and for the brochure, *Graduate Work in Anthropology*, write to Graduate Field Representative, Department of Anthropology, Morrill Hall.

ASIAN STUDIES *(ARTS)*

Faculty: K. Biggerstaff, N. C. Bodman, J. M. Echols, G. H. Fairbanks, F. H. Golay, C. F. Hockett, R. B. Jones, Jr., G. McT. Kahin, J. W. Lewis, T. C. Liu, R. M. Marsh, J. W. Mellor, H. C. Mills, M. E. Opler, H. Shadick, L. Sharp, G. W. Skinner, R. J. Smith, M. W. Young.

APPROVED MAJOR AND MINOR SUBJECTS

Chinese Literature 1, 2, 3, 4
Asian Studies 3, 4

Language requirements for the Master's degree: proficiency in French, German, Russian or Japanese by the beginning of the second semester of residence.

Graduate work in Chinese literature assumes at least two years of Chinese language study prior to admission. Requirements for the Doctor's degree with a major in Chinese literature: (1) familiarity with representative works in classical and vernacular Chinese; (2) broad knowledge of the available translations of Chinese literature and critical studies in Western languages; (3) specialized knowledge of at least two subfields such as the Confucian or Taoist classics, poetry, drama, fiction, classical prose, or twentieth-century writings.

The requirements for the M.A. degree or for a minor in Chinese literature are roughly equivalent to (1) and (2) above.

The minor in Asian studies demands a specialized knowledge of China, South Asia, or Southeast Asia. A candidate for the Ph.D. minoring in Asian studies is expected to be able to carry on research in the appropriate Asian language. The requirements of the minor are set forth in the *Announcement of the Department of Asian Studies,* available from the department office, Franklin Hall.

Several fellowships and research assistantships are available for which application should be made directly to the Director of the China Program, the Director of the Southeast Asia Program, or the Chairman of the Committee on South Asian Studies. These are described more fully on pp. 36, 37 and 40 of this Announcement.

The work of the Department of Asian Studies is recognized and supported by the United States Office of Education. Under the National Defense Education Act Cornell has three Language and Area Centers: East Asia, South Asia, and Southeast Asia. Languages currently offered are Burmese, Chinese (Mandarin and Hokkien), Hindi, Indonesian, Japanese, Malay, Pali, Sanskrit, Sinhalese, Thai, Urdu, and Vietnamese. Graduate students in Asian Studies are eligible for the National Defense Foreign Language Fellowships offered by the U. S. Office of Education. Application forms should be requested directly from the Graduate School and returned to it for forwarding to the U.S. Office of Education if approved.

Graduate students in Asian studies are also eligible for the Foreign Area Training Fellowships administered by the Social Science Research Council for study in the United States and for research overseas. Fulbright teaching and research awards for Taiwan, Hongkong, India, Japan, Malaya, Pakistan, Philippines, Singapore, and Thailand are available to qualified graduate students who are citizens of the United States.

For additional details write for the *Announcement of the Department of Asian Studies,* Franklin Hall.

BUSINESS AND PUBLIC ADMINISTRATION

Faculty: R. E. Baker, F. T. Bent, H. Bierman, E. Brooks, W. D. Carmichael, G. C. Chow, M. G. de Chazeau, R. H. Elling, F. F. Gilmore, A. M. Hillhouse, J. G. B. Hutchins, F. LeRocker, T. M. Lodahl, A. K. McAdams, G. R. Morrison, A. E. Nilsson, R. V. Presthus, J. M. Rathmell, S. Smidt, D. A. Thomas, P. P. Van Riper, J. H. Walters, P. Wasserman, R. F. White.

APPROVED MAJOR AND MINOR SUBJECTS

Business Administration 1, 3, 4
Public Administration 1, 3, 4
Managerial Economics 1, 3, 4
Finance and Accounting 3, 4
Marketing 3, 4
Production 3
Hospital Administration 3, 4

The professional degrees of Master of Business Administration and Master of Public Administration are awarded by action of the faculty of the Graduate School of Business and Public Administration under conditions imposed by that faculty, and the prospective candidate should consult the *Announcement of the Graduate School of Business and Public Administration.*

The Ph.D. program in the Field of Business and Public Administration is designed to provide an advanced, comprehensive education in administration, public or private, primarily for men who seek careers in teaching or research in this field.

Candidates for the Ph.D. degree proposing to major in this field must select a major subject from among those listed above. The candidate's two minor subjects may also be selected from this list; but it is the policy of the Field of Business and Public Administration to encourage the student to select one of his two minor subjects from related subjects outside the field. For this purpose, students majoring in this field should consult the description in this Announcement of other fields, such as the Fields of Agricultural Economics, Economics, and Industrial and Labor Relations.

Ph.D. candidates with majors in fields other than business and public administration, who wish to minor in this field, may also choose from among the subjects listed above, excluding production which is available as a minor subject only for candidates with a major subject in this field. Except for unusual cases, minors at the Master's level are not permitted in this field. Requirements of a minor subject in this field, while less comprehensive than a major, presume a suitable foundation for advanced work.

Brief descriptions of the scope and method of the subjects in the Field of Business and Public Administration are outlined below:

GENERAL REQUIREMENTS

Since the Ph.D. degree with a major subject in the Field of Business and Public Administration is designed primarily to prepare candidates for teaching and research, there are certain common requirements of which the prospective student should be aware. Early in his program he should acquire competence in research methodology appropriate to his major subject which he must demonstrate later in the preparation of his Ph.D. dissertation. Since to read much of the literature in business subjects requires a minimum competence in mathematics, including an understanding of algebra, basic statistics, and calculus, a candidate will be encouraged, although not required, to develop such an understanding.

The candidate who majors in business administration or in managerial economics must develop, if he does not already possess, a reasonable grasp of three auxiliary business subjects closely related, but in addition to his major and minor subjects in the field. If not selected as a minor, one of these subjects must be business administration or managerial economics and the remainder will be selected from the following subjects: accounting, finance, marketing, production, personnel management and human relations. This requirement of three auxiliary business subjects may be satisfied by a written examination equivalent to a course examination at the Master's level.

The candidate who majors in public administration must demonstrate similar competence in complementary subjects including statistics, American government, basic sociology, and basic economics.

Business Administration. This subject embraces the relationship of the business firm to its economic, political, and social environment and an understanding of the art and science of administering organizations, including organizational theory, coordination and control, communications, power relationships, policy formulation, and program development. A thesis in this subject area may stress one of the functional areas in business but it must also focus the relationship of that function to the administration of the firm as a whole.

Public Administration. The candidate will be required to develop an interdisciplinary approach to public administration including a study of methodology in the social sciences; bureaucratic theory and organizational behavior; governmental policies and operations, domestic and foreign; management services such as personnel, budgeting, and government accounting; and the social, political, and economic environment of public administration.

Managerial Economics. The candidate with a major in this subject will be expected to demonstrate competence in basic economics including an understanding of accounting and price theory, the allocation of resources within the firm, business fluctuations and social control of the economy. He must develop understanding in depth of a significant area of macro-economics or of micro-economics as it affects business activity and the business firm; and of economic analysis as applied to administrative decision making. Within this subject area, the candidate may choose to stress either the methods of quantitative or those of qualitative economic analysis.

Admission to the Ph.D. program in business and public administration generally presumes academic work in administration or related social science fields at the Master's level. Ordinarily the candidate is expected to have a Master's degree, but this is not an absolute requirement.

A number of fellowships and scholarships are made available each year for candidates for the Ph.D. degree in business and public administration (see Fellowships and Scholarships, p. 17). Prospective students interested in teaching or research assistantships should direct their inquiries to the Field Representative, Graduate School of Business and Public Administration, McGraw Hall.

CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS *(H.E.)*

Faculty: A. L. Baldwin, H. Bayer, W. L. Brittain, U. Bronfenbrenner, R. H. Dalton, E. C. Devereux, Jr., H. Feldman, M. E. Ford, J. Harding, H. Levin, C. P. Melville, E. O. Peisner, K. M. Reeves, H. Ricciuti, G. Suci.

APPROVED MAJOR AND MINOR SUBJECTS

Child Development and Family Relationships 1, 2, 3, 4
Child Development 3, 4
Family Relationships 3, 4

Admission to graduate work is based primarily on evidence of the student's competence to do advanced work and on broad preparation as a basis for specialization. Opportunities to acquire background in the behavioral sciences are available, and the graduate student with relatively little preparation in the behavioral sciences should plan on additional time for the completion of the degree.

The department has a number of research projects in which students may participate. A series of research *practica* has been instituted in conjunction with, but not as part of, on-going research projects for the purpose of training the student in the formulation of problems, the development of research design, and the analysis and interpretation of data.

Approximately 20 teaching and research assistantships are available. Application should be made directly to the Department of Child Development and Family Relationships.

Since the subject matter in child development and family relationships draws on several disciplines, students are encouraged to supplement their work with studies in related fields. For courses in these related fields, see the *Announcements of the Colleges of Agriculture, of Arts and Sciences, and of Home Economics, and of the Schools of Industrial and Labor Relations and Education.*

CITY AND REGIONAL PLANNING *(ARCH.)*

(See p. 46.)

ECONOMICS *(ARTS)*

Faculty: G. P. Adams, Jr., M. G. Clark, M. A. Copeland, T. E. Davis, M. G. de Chazeau, D. F. Dowd, F. H. Golay, G. H. Hildebrand, J. G. B. Hutchins, A. E. Kahn, R. W. Kilpatrick, T. C. Liu, R. E. Montgomery, C. Morse, P. M. O'Leary, B. P. Stigum.

APPROVED MAJOR AND MINOR SUBJECTS

Econometrics and Economic Statistics 1, 2, 3, 4
Economic Development 2, 3, 4*
Economic History 1, 2, 3, 4
Economic Theory and Its History 1, 2, 3, 4
Industrial Organization and Control 1, 2, 3, 4
International Economics 1, 2, 3, 4
Labor Economics 1, 2, 3, 4
Monetary, Financial, and Fiscal Economics 1, 2, 3, 4

Students majoring in this field should consult the descriptions in this Announcement of the Fields of Agricultural Economics, Business and Public Administration, and Industrial and Labor Relations for other subjects related to the work in economics.

Language requirement for Master's degree: proficiency in an approved foreign language must be established before taking the final examination.

1. All candidates resident in the United States during the year preceding matriculation at Cornell must take the Graduate Record Examination Aptitude Test.

2. In addition to their major and two minors, doctoral candidates will be required to demonstrate competence in economic theory, its history, and its methodology, the latter including economic statistics, social accounting, and, except where the major adviser explicitly approves an exemption, mathematical economics. A student who elects as a major or minor any of these required subjects must broaden his program by taking work in "outside subjects" approved by his Special Committee.

3. All candidates for advanced degrees who elect a minor in economics will be held for work in economic theory.

4. Candidates for the Ph.D. degree with a major in economics are encouraged to elect one minor subject in another field.

5. Applications for fellowships and scholarships in economics should be filed with the Dean of the Graduate School prior to the deadline date (see Calendar). Applications for teaching

*May not combine with a major in International Economics for the M.A.

assistantships, however, should be made directly to the Chairman of the Department of Economics.

EDUCATION AND RURAL EDUCATION *(ED.)*

Faculty: H. G. Andrus, J. P. Bail, A. L. Baldwin, F. C. Baldwin, S. Blackwell, M. H. Bruce, Jr., R. L. Bruce, R. N. Campbell, M. M. Carmichael, B. Cosby, K. P. Cross, H. R. Cushman, W. E. Drake, A. E. Durfee, R. H. Ennis, J. Failing, R. B. Fischer, F. F. Foltman, H. A. Geiselmann, M. D. Glock, D. B. Gowin, C. W. Hill, R. J. Hills, L. B. Hixon, M. Johnson, Jr., P. G. Johnson, J. P. Leagans, W. E. Lowe, D. J. McCarty, J. Millman, O. G. Mink, H. Moser, A. G. Nelson, H. Y. Nelson, V. C. Nuccio, I. Patterson, W. J. Pauk, I. Peard, K. Reeves, K. Rhodes, R. E. Ripple, V. N. Rockcastle, W. A. Smith, F. H. Stutz, F. K. T. Tom, G. F. Vars, H. Wardeberg.

APPROVED MAJOR AND MINOR SUBJECTS

Agricultural Education 1, 2, 3, 4
Education 3, 4
Educational Administration and Supervision 1, 2, 3, 4
Educational Psychology and Measurement 1, 2, 3, 4
Elementary Education 1, 2, 3, 4
Extension and Adult Education 1, 2, 3, 4
Guidance and Personnel Administration 1, 2, 3, 4
History and Theory of Education 1, 2, 3, 4
Home Economics Education 1, 2, 4
Development of Human Resources 1, 2, 3, 4
Nature, Science, and Conservation Education 1, 2, 3, 4
Secondary Education and Curriculum 1, 2, 3, 4

Students in education may be admitted to candidacy for two types of advanced degrees: (1) the general degrees, M.A., M.S., or Ph.D., or (2) the professional degrees, M.A.T., M.Ed., or Ed.D. Requirements for (2) and a listing and description of courses in this field are to be found in the *Announcement of the School of Education.*

The requirements for admission to candidacy for the general degrees are the same as those for the professional degrees. In the Field of Education there is no foreign language requirement for Masters' degrees unless stipulated by the candidate's Special Committee.

GENERAL LINGUISTICS *(ARTS)*

Faculty: F. B. Agard, N. C. Bodman, J M. Cowan, J. M. Echols, G. H. Fairbanks, W. H. French, R. A. Hall, Jr., C. F. Hockett, R. B. Jones, Jr., H. L. Kufner, R. L. Leed, C. S. Leonard, Jr., M. Samilov, I. S. Shah, D. F. Solá.

APPROVED MAJOR AND MINOR SUBJECT

General Linguistics 1, 2, 3, 4

All applicants resident in the United States during the year before entering the Graduate School are required to submit their scores in the Graduate Record Examination Aptitude Test when they apply for admission.

The following more specialized subjects, listed elsewhere, are also available: speech and phonetics (see Speech and Drama); Latin language, Greek language (see the Classics); Old and Middle English (see English Language and Literature); Germanic linguistics (see German); French, Spanish, and Romance linguistics (see Romance Studies); Slavic linguistics (see Russian); Chinese, Southeast Asian and South Asian linguistics (see Asian Studies).

Special research interests of the staff members, in which formal or informal course work can be arranged upon demand, range widely, and the following list is intended merely as suggestive: pidginized and creolized languages; dialectology and linguistic geography, especially in the French, German, Italian, and Russian areas; comparative Indo-European; classical and modern Armenian; Pali and Old Persian; American Indian languages; language and culture; information theory.

The M.A. program with a major in general linguistics is broad and flexible, designed to provide for the training of students with highly diverse aims, from foreign language teaching (including the teaching of English as a second language) to machine processing of language data. For an M.A. candidate who intends to continue towards a Ph.D., a reading knowledge of one foreign language approved by the Graduate School is required.

The Ph.D. program in general linguistics is designed for the training of experts thoroughly at home in the whole range of pure and applied linguistics. A minor in social anthropology is required. Familiarity with mathematics is highly desirable. In addition to the Graduate School's foreign language reading requirement, every Ph.D. candidate must demonstrate fluent oral control in one language other than his native language.

Inquiries for further information should be directed to the Graduate Field Representative for General Linguistics, Division of Modern Languages.

GEOGRAPHY *(ARTS)*

(See p. 92.)

GOVERNMENT *(ARTS)*

Faculty: A. Altshuler, W. F. Berns, H. W. Briggs, A. T. Dotson, M. Einaudi, G. Fischer, A. Hacker, G. McT. Kahin, J. Lewis, T. Lowi, S. Muller, C. Rossiter.

APPROVED MAJOR AND MINOR SUBJECTS

American Government and Institutions 1, 2, 3, 4
Comparative Government 1, 2, 3, 4
Constitutional Law 1, 2, 3, 4
International Law and Organization 1, 2, 3, 4
International Relations 1, 2, 3, 4
The Political Process 1, 2, 3, 4
Political Theory 1, 2, 3, 4
Public Administration 1, 2, 3, 4

A candidate for the Ph.D. may, with the consent of his Committee, substitute one of the following languages for French, German, or Russian: Burmese, Chinese, Hindi, Indonesian, Thai, and Vietnamese. At the discretion of his Special Committee a candidate for the M.A. degree may be required to demonstrate reading ability in one foreign language.

For graduate work in government a candidate should have a general knowledge of political science, history, sociology, economics, and international affairs. It is recommended that candidates for the Ph.D. with major study in government should take at least one minor outside the field.

For candidates for the Ph.D. with a major in government, Examination A of the final examination consists of a comprehensive written examination, followed by an oral examination. Examination A shall comprise American government and institutions, political theory, and three additional subjects to be selected by the candidates: (1) from the approved major and minor subjects listed by the Field of Government; or (2) where minor subjects are taken outside the Field, from such minors as may be required by the professor in charge. A candidate will be required to pass Examination A before commencing work on the thesis, and to take this examination prior to the beginning of the sixth term of residence, unless the field sets an earlier or later time limit due to special circumstances. The Field of Government will set examinations to begin on the third Monday of September, January, and May.

All applicants for admission to graduate study in government must submit the scores of the Graduate Record Examination Aptitude and Advanced Tests with their other credentials.

HISTORY *(ARTS)*

Faculty: K. Biggerstaff, D. B. Davis, E. W. Fox, P. W. Gates, T. R. Graham, H. Guerlac, D. Kagan, W. F. LeFeber, F. G. Marcham, C. P. Nettels, W. M. Pinter, E. F. Rice, Jr., W. M. Simon, B. Tierney, L. P. Williams.

APPROVED MAJOR AND MINOR SUBJECTS

American History 1, 2, 3, 4
Latin American History 1, 2, 3, 4
Ancient History 1, 2, 3, 4
Modern Chinese History 1, 2, 3, 4
English History 1, 2, 3, 4
European History since 1789 1, 2, 3, 4
History of Science 1, 2, 3, 4
Medieval History 1, 2, 3, 4
Early Modern European History 1, 2, 3, 4
Russian History 1, 2, 3, 4
Southeast Asian History 1, 2

The language requirement for the Master's degree: proficiency in French, German, or Russian. Candidates in American or Latin American history may meet the requirement with proficiency in Spanish. Another foreign language may be substituted if, in the judgment of the candidate's Special Committee, the relative amount, quality, and pertinence of source materials and scholarly writing in the candidate's approved major subject are superior in that language to the one for which it is substituted. All candidates are expected to fulfill the language requirement upon entrance.

In the case of candidates for whom the M.A. will be the terminal degree and who do not need the language for research, the Department of History will entertain petitions for waiving the language requirement.

Candidates for the Ph.D. must demonstrate proficiency in two of the following languages: German, French, Russian; candidates for the same degree in American or Latin American history may choose Spanish as one of the two languages. Candidates for the Ph.D. in Chinese and Southeast Asian history must choose Chinese and a Southeast Asian language, respectively, as one of the two languages. Candidates for the Ph.D. in Russian history must have a reading knowledge of Russian. Candidates for the Ph.D. in ancient history must read both Greek and Latin in addition to French and German, and in medieval history must read Latin in addition to two of the approved languages.

All candidates are expected to demonstrate proficiency in at least one language upon entrance. All language requirements must be completed before a candidate may take the A Examination.

Candidates majoring in history may take minors in other history subjects or in other fields of the Graduate School.

For available fellowships see pp. 17–26. Prospective students interested in applying for assistantships, of which a number are available to students who have already completed at least one year of graduate study, should write directly to the Chairman, Department of History, West Sibley Hall. All applicants for admission to graduate study in history must include the scores of the Graduate Record Examination Aptitude Test with their other credentials.

HOME ECONOMICS, GENERAL *(H.E.)*

Faculty: See Child Development and Family Relationships, Household Economics and Management, Food and Nutrition, Home Economics Education, Housing and Design, Institution Management, Textiles and Clothing.

APPROVED MINOR SUBJECT

General Home Economics 5

For students who wish the minor to give breadth of contact with the Field of Home Economics rather than depth in one area. Courses to be selected from the offerings in several of the areas of home economics. Approved as a minor subject for the Master's degree only.

HOME ECONOMICS EDUCATION *(H.E., ED.)*

Faculty: S. Blackwell, M. M. Carmichael, H. Moser, H. Nelson, I. Patterson, K. Rhodes.

APPROVED MAJOR AND MINOR SUBJECT

Home Economics Education 1, 2, 4

Graduate students may have a major or a minor in home economics education during candidacy for any one of the following degrees:

General degrees—Master of Science, Doctor of Philosophy.

Professional degrees—Master of Education, Doctor of Education.

(See *Announcement of the School of Education* for requirements for professional degrees.)

A candidate for an advanced degree with a major or minor in home economics education is expected to have an undergraduate major in home economics and some courses in education. Experience in teaching is desirable as a basis for graduate work and may be accepted in some cases in lieu of undergraduate courses in education.

Graduate students prepare for positions in many phases of home economics education, such as adult education, extension teaching, secondary school teaching, college teaching, administration and supervision of home economics programs, and research in home economics education. Students may observe and participate in home economics programs at all age levels through the schools, the College of Home Economics, the Extension Service, and other agencies.

Candidates for advanced degrees with a major in home economics education are expected to acquire a general knowledge of (1) the history and philosophies of education; (2) principles of (a) curriculum development, (b) educational psychology, (c) teaching methods, (d) evaluation, and (e) research methods in education.

Departmental research projects provide opportunities for students to gain experience in research procedures and may yield data for theses of Masters' or doctoral candidates. Projects in progress during 1962–1963 include (a) adolescents' understanding of concepts and generalizations important in family life education, (b) a study of problems in programs of home economics for adults, and (c) factors related to the college teaching of home economics.

HOTEL ADMINISTRATION *(HOTEL)*

Faculty: R. A. Beck, P. R. Broten, C. E. Cladel, M. H. Ericson, G. W. Lattin, H. J. Recknagel, C. I. Sayles, T. W. Silk, L. L. Smith, J. J. Wanderstock.

APPROVED MAJOR AND MINOR SUBJECTS

Hotel Administration 1, 2, 4 Hotel Accounting 2, 4

Graduate work in the Field of Hotel Administration is open to those who have completed in full the requirements for the undergraduate degree in the School of Hotel Administration and to them only.

Students who hold Bachelors' degrees in the liberal arts or in general business administration who wish a program in hotel administration normally enroll in the undergraduate division. They may become candidates for an additional Bachelor's degree or at their choice simply enroll for a specialized program of hotel administration courses suited to their particular needs.

HOUSEHOLD ECONOMICS AND MANAGEMENT *(H.E.)*

Faculty: G. J. Bymers, A. J. Davey, M. E. Purchase, M. A. Rollins, R. E. Steidl, K. E. Walker, J. Warren.

APPROVED MAJOR AND MINOR SUBJECTS

Household Economics and Management 1, 2, 4 Household Management 2, 3, 4
Household Economics 2, 3, 4

A well-rounded undergraduate program in home economics or specialization is acceptable as background for study in this field. Students with majors other than home economics for their baccalaureate degrees will also be considered since other subject matter areas are applied to the work and finances of the home.

The Field offers opportunities for study and research with staff members having specialized interests in consumption economics, marketing, family financial management, family economics, design and layout of work areas, household equipment, chemical and physical processes applied to household work, work simplification, and home management.

Students selecting a major in household economics and management are expected to take courses in both phases of the Field; for the degree of Ph.D. the minor subjects are usually selected to support one phase or the other. Since the subject matter in household economics

and management draws on several disciplines, appropriate minor subjects may be chosen from a variety of fields including the Fields of Agricultural Economics, Economics, Education, Industrial and Labor Relations, Psychology, and Sociology, as well as other branches of home economics.

HOUSING AND DESIGN *(H.E.)*

Faculty: J. Adler, G. H. Beyer, L. L. Bower, H. J. Cady, G. C. Millican, S. Neblett, V. True, A. L. Welling.

APPROVED MAJOR AND MINOR SUBJECT

Housing and Design 1, 2, 3, 4

Language requirement for the Master's degree: college entrance language, or proficiency before beginning of second residence unit.

For the degree of M.A. with a major in housing and design, the work may be focused in housing or in design. The student should have a general knowledge of basic concepts of the particular area (or branch of the area) in the Field of Housing and Design in which he proposes to major.

The program for the degree of M.A. varies for each phase of study. Flexibility in programing cares for varying backgrounds and objectives of students. A major must obtain comprehensive knowledge of one of the subjects of this field. The student is required to fill in gaps in his background where they apply in such areas as social science, fine arts, statistics, and research methods. Such a student may need to spend additional time at Cornell. The candidate should choose a minor in a related field.

A major in the Field of Housing and Design leading to the Ph.D. degree is offered. The emphasis is on the socio-economic and family aspects of housing.

For work toward the doctorate with a major in housing and design the student must expand his knowledge beyond the specialized subject in which he focused for work toward the Master's degree. Professional experience is desirable. Two minors are selected from fields related to housing and design.

Members of the staff will direct work in the following subject matter areas: *Design:* Professors Adler, Cady, Millican, Neblett, True; *Socio-economic Aspects of Housing and General Housing Research:* Professors Beyer and Bower.

INDUSTRIAL AND LABOR RELATIONS *(I.L.R.)*

Faculty: L. P. Adams, R. L. Aronson, I. Blumen, P. E. Breer, T. Burling, R. N. Campbell, J. T. Carpenter, M. G. Clark, A. H. Cook, D. E. Cullen, R. H. Ferguson, F. F. Foltman, W. H. Friedland, K. L. Hanslowe, G. H. Hildebrand, W. L. Hodges, V. H. Jensen, M. R. Konvitz, H. A. Landsberger, A. H. Leighton, D. M. MacIntyre, P. J. McCarthy, J. W. McConnell, J. T. McKelvey, E. Mesics, F. B. Miller, J. G. Miller, R. E. Montgomery, J. O. Morris, M. F. Neufeld, R. L. Raimon, R. F. Risley, N. A. Rosen, F. Slavick, A. W. Smith, N. A. Tolles, H. M. Trice, W. J. Wasmuth, W. F. Whyte, B. F. Wilcox, L. K. Williams, J. P. Windmuller.

APPROVED MAJOR AND MINOR SUBJECTS

Collective Bargaining, Labor Law, and Labor Movements 1, 2, 3, 4

Economic and Social Statistics 1, 2, 3, 4
Human Resources and Administration 1, 2, 3, 4
Labor Economics and Income Security 1, 2, 3, 4
Industrial and Labor Relations Problems 4
International and Comparative Labor Relations 3, 4

Language requirement for Master's degree: proficiency in one language approved by the Special Committee before beginning the second residence unit.

A description of the program leading to the degree of Master of Industrial and Labor Relations, which is designed to provide broad coverage and some specialization, is found in the *Announcement of the School of Industrial and Labor Relations.*

For both the M.S. and Ph.D. degrees emphasis is placed upon independent study and research. The following are minimum requirements prerequisite to the independent investigations required in the major or minor subjects:

COLLECTIVE BARGAINING, LABOR LAW, AND LABOR MOVEMENTS. For a Ph.D. major, the candidate must show proficiency in the following areas of knowledge: (1) history of the labor movement and collective bargaining in the United States; (2) history of unionism and labor relations in major industries; (3) theories of trade unionism and collective bargaining; (4) structure, government, administration, and activities of the labor movement and of major national unions; (5) structures, procedures, practices, and major issues in collective bargaining; (6) federal and state legislation and leading cases in labor relations law; (7) role of government in labor relations, with emphasis on the methods and implications of different forms of dispute settlement; (8) history and problems of labor movements in labor relations in other countries; (9) bibliography and major sources of information in collective bargaining and trade unionism.

For a Ph.D. minor, (1), (3), (4), (5), (6), and (7) are required.
For an M.S. major, (1), (4), (5), (6), and (7) are required.
For an M.S. minor, (1), (4), and (5) are required.

ECONOMIC AND SOCIAL STATISTICS. For a major in this subject the candidate must show (1) good command of the principles of statistical reasoning; (2) proficiency in the use of statistical methods and in the processing of statistical data; (3) qualified skill in the application of proper statistical tools of analysis to a specific topic in economics or social studies, including a thorough knowledge of statistical sources; (4) knowledge of differential and integral calculus.

For a minor, (1), (2), (3) are required, the level being less advanced than for a major.

HUMAN RESOURCES AND ADMINISTRATION. For a major in this subject the candidate must demonstrate:

1. Knowledge of the fields basic in individual and social behavior and of concepts of administration and supervision.

2. Special competence in one of three areas of study, as follows:

   A. *Human Relations*

   (1) The principal human relations problems commonly found in industrial and labor relations and the bearing of these problems on other fields such as collective bargaining, labor organization, management organization, economics, and law; (2) the problems involved in the relationship between industries and communities; (3) resources generally available in educational techniques and community services that have bearing on human relations problems; (4) theories of human organization.

   B. *Development of Human Resources*

   (1) Social, economic, and political factors which influence the value and scope of educational and training activities conducted for the development of manual, technical, and managerial personnel; (2) the philosophy, controlling purpose, and organizational setting characteristic of development programs in industry, academic institutions, labor organizations, governmental agencies, private trade associations, and consulting services; (3) organizational behavior and administrative practices which assist or hinder the growth and development of the individual; (4) understanding of organization, techniques, and operations of activities utilized in the development of manual, technical, and managerial personnel.

   C. *Personnel Management*

   (1) Understanding of the nature and scope of the personnel function and the social, economic, and political factors which influence its development; (2) knowledge of the organization of the personnel function and the techniques, methods, and procedures utilized in carrying on the personnel activities of an organization; (3) knowledge of industrial and labor legislation and regulatory functions of government as related to the personnel function; (4) understanding of basic factors affecting the relationships between individuals and groups within an organization and between organizations.

3. Ability to isolate issues worthy of research, to identify and locate relevant studies or other sources of information, and independently to develop and conduct additional research.

For a minor 1 and 3 and either 2-A (1) and (4), or 2-B (1) and (2), or 2-C (1) and (2).

INDUSTRIAL AND LABOR RELATIONS PROBLEMS. (Offered as a minor only to graduate students in fields of study other than industrial and labor relations.)

A candidate for an advanced degree must have a general understanding of the subject matter in the Field of Industrial and Labor Relations. In order to prepare for a minor in this field, the candidate will normally complete three to five courses in accordance with a program approved by his Special Committee.

INTERNATIONAL AND COMPARATIVE LABOR RELATIONS. (Available only as a minor subject.)

This subject of study is concerned with (1) the development and current role of labor movements in countries in various stages of industrialization with special reference to ideological, economic, political, and social factors influencing the history, policies, and activities of labor organizations; (2) the development and current state of industrial management, with emphasis on recruitment, training, utilization, and ownership patterns; (3) similarities and diversities in systems of labor-management relations at different stages of economic development; (4) labor market, wage policy, and economic security problems, especially in countries undergoing rapid economic change; and (5) the development and programs of national and international organizations (ILO, ICFTU, WFTU, ITS, U.S. government agencies, trade unions, and management) having special competence and interests in international labor questions.

In addition to attaining, through comparative techniques and other methods, a basic knowledge of (1), (2), (3), (4), and (5), students electing a minor in international and comparative labor relations are expected to acquire a thorough knowledge of labor problems and labor-management relations in *one* specific country or area other than the United States.

LABOR ECONOMICS AND INCOME SECURITY. This field of study involves analysis of the labor force, labor markets, wages and related terms of employment, income distribution, unemployment, health and safety in industry, superannuation, and private programs and legislation designed to meet income and employment problems.

For a major in this field, the candidate must demonstrate (1) comprehensive knowledge of historical developments and current issues in the area of employment and income; (2) skill in analysis of economic, political, social, and administrative problems in this field; (3) knowledge of the significant legislation dealing with income, employment, and employee welfare; (4) detailed acquaintance with the literature and sources of information in the field; (5) familiarity with income and employment problems and related legislation in selected foreign countries.

For a minor, (2) and (3) are required.

Applicants must include in their credentials the results of the Graduate Record Examination (Aptitude Test). If, for satisfactory reasons, a person cannot take the examination before he wishes his application considered, the admissions committee may act provisionally pending submission of scores at a later date.

Applicants may be interviewed in Ithaca (and occasionally elsewhere) by members of the Graduate Committee of the field and by other faculty members representing subjects in which the candidate proposes to study. Inquiries concerning interviews should be directed to the Graduate Field Representative, New York State School of Industrial and Labor Relations.

Applications for graduate assistantships to begin in September should be received not later than February 1; for February, not later than November 1. Write to the Graduate Field Representative for application material.

Note, also, the fellowships of the Field of Industrial and Labor Relations and the special tuition scholarships, pp. 21–22.

INSTITUTION MANAGEMENT *(H.E.)*

Faculty: M. BLOETJES, A. BURGOIN, K. CUTLAR, K. LONGRÉE.

APPROVED MAJOR AND MINOR SUBJECT

Administrative Dietetics 2, 4

A strong background of undergraduate courses in food and nutrition and the supporting physical and biological sciences and a well-balanced program in other branches of home economics are expected. Undergraduate courses in institution management and some experience in managerial dietetics or commercial food service administration are desirable.

Graduate work leading to the Master's degree may emphasize either the administrative or the more technical aspects of institution management. There is no prescribed program of study for either the major or the minor in this field. It is expected that the program will supplement the student's previous training and experience to achieve a well-rounded knowledge of the subject, with due consideration given to the student's purpose in undertaking graduate study.

Related minors are in other branches of home economics, particularly food and/or nutrition, or in such subjects as personnel administration, agricultural marketing, hotel accounting, and education.

Members of the staff will direct work in institution administration and management and in experimental quantity cookery.

The department offers opportunities for experimentation in the research kitchen and the cafeteria. Several graduate assistantships are available.

LATIN AMERICAN STUDIES *(ARTS)*

Faculty: D. Brenes, H. E. Conklin, T. Davis, B. L. Ellenbogen, R. K. Goldsen, R. Graham, A. R. Holmberg, H. A. Landsberger, D. F. Solá, J. M. Stycos, W. F. Whyte.

APPROVED MINOR SUBJECT

Latin American Studies 4

The requirements for the minor in Latin American studies include (1) a reading knowledge and speaking knowledge of Spanish (some knowledge of Portuguese is recommended but not required) and (2) a knowledge of Latin American history, culture, political organization, and problems of economic development.

LAW

Faculty: H. W. Briggs, M. H. Cardozo, W. D. Curtiss, W. T. Dean, W. H. Farnham, H. A. Freeman, K. Hanslowe, H. G. Henn, W. E. Hogan, M. R. Konvitz, J. W. MacDonald, I. R. Macneil, L. W. Morse, R. S. Pasley, N. Penney, R. B. Schlesinger, G. Thoron, E. N. Warren, B. F. Willcox.

APPROVED MINOR SUBJECT

Law 4

RURAL SOCIOLOGY *(AG.)*

Faculty: F. D. Alexander, G. J. Cummings, R. A. Danley, B. L. Ellenbogen, J. Harp, O. F. Larson, R. A. Polson, W. W. Reeder, P. Taietz, H. E. Thomas, R. M. Williams, Jr., F. Young.

APPROVED MAJOR AND MINOR SUBJECTS

Rural Sociology 1, 2, 4
Organization Methods and Community Development 2, 3, 4
Methods in Social Research 2, 3, 4

Some of the occupations which graduates in rural sociology most frequently enter are college teaching and research in rural sociology; extension work in rural sociology; community development and extension work in foreign cultures and in underdeveloped areas; social research work with government and private organizations; and consultation in organization methods and community development. Many foreign students find this training fits their needs as they prepare for similar activities in their own countries.

Several teaching and research assistantships are available. Application should be made directly to the Department of Rural Sociology.

Research assistants and some other graduate students have the opportunity to participate in planning and carrying out the department's research programs under the supervision of project

leaders. Some of the projects currently active are: social change in rural areas; the rural-urban fringe; migratory farm labor problems; program planning procedures; old age and retirement; population trends; experiments in community development; the sociology of health; social participation; recruitment for professional services in rural areas; and part-time and low income farmers.

Supervised field experience in organization methods and community development is also being instituted for mature, interested students. Those interested in some of the applications of research have an opportunity to observe and participate in the Department of Rural Sociology projects in extension work and in studies designed to test extension methods.

A student offering *Rural Sociology as a major for the Ph.D. degree* is expected to acquire a thorough knowledge of (a) sociological theory and its history, (b) the methodology of sociological research, (c) rural sociology and the research in this field, and (d) organization methods and community development.

When *rural sociology* is offered as a *major for the M.S. degree* or as a *minor for the Ph.D. degree,* the candidate is expected to acquire a general knowledge of sociological theory, (b), (c), and (d) listed above.

When *organization methods and community development* is offered as a *major for the M.S. degree* or as a *minor for the Ph.D. degree,* the candidate is expected to acquire a thorough knowledge of organization methods and community development and a general knowledge of sociological theory, (b), and (c), listed above.

When *methods in social research* is offered as a *major for the M.S. degree,* the candidate is expected to acquire a thorough knowledge of the methodology of sociological research and a general knowledge of (a), (c), and (d) listed above.

When *methods in social research* is offered as a *minor for the Ph.D. degree,* the candidate is expected to acquire a thorough knowledge of the methodology of research employed in his major field and in his second minor field.

Majors for the Ph.D. degree are required to take one minor outside the Field of Rural Sociology and in most cases will be encouraged to take both minors outside the major field.

In general, for an M.S. major in the Field of Rural Sociology, the minor should be selected outside the field.

While any minor is possible such minors as general sociology, social psychology, anthropology, family relationships, guidance and personnel administration, extension education, agricultural economics, statistics, and mathematics are among those most closely related and most frequently chosen.

The various college Announcements, which describe courses, should be consulted. Of interest to Rural Sociology majors and minors will be the offerings of the Departments of Sociology, Anthropology, and Psychology in the College of Arts and Sciences; of the Departments of Rural Education and Agricultural Economics in the College of Agriculture; of the Department of Child Development and Family Relationships in the College of Home Economics; of the School of Industrial and Labor Relations; of the Graduate School of Business and Public Administration; and of the College of Architecture. Students interested in the Far East will wish to consult the *Announcement of the Department of Asian Studies,* obtainable from that department in Franklin Hall.

SOCIOLOGY *(ARTS)*

Faculty: W. Delany, A. Feldt, R. K. Goldsen, W. W. Lambert, R. M. Marsh, J. W. McConnell, R. McGinnis, G. C. Myers, L. Meltzer, G. F. Streib, J. M. Stycos, W. E. Thompson, W. F. Whyte, R. M. Williams, Jr.

APPROVED MAJOR AND MINOR SUBJECTS

General Sociology 2, 4
Social Organization and Change 1, 3, 4
Social Psychology 1, 3, 4
Research Methodology 1, 3, 4
Demography-Ecology 1, 3, 4

Language requirement for the Master's degree: proficiency in one language acceptable to the Special Committee as soon as possible and no later than the second semester in residence, or a two-semester sequence in Mathematics for Social Scientists. (Math. 201–202).

In addition to a general background in the social sciences, the entering student should have some knowledge of the basic concepts and applications of quantitative analysis. Graduate Record Examination scores are required for admissions consideration.

The department sponsors various social research programs and field projects in which graduate students may participate for purposes of research training. Research activities of the staff have included studies in intergroup relations, values, demography, organizational behavior, social gerontology, small groups, and political sociology. Staff members also participate closely in teaching and research activities of the Asian and Latin American area programs. While research assistantships are normally granted only to students already in residence, a number of teaching assistantships are awarded annually to incoming students. The International Population Program provides fellowships and research internships to selected students of demography. Applications should be made directly to the Field Representative, Department of Sociology, Morrill Hall.

The Master's program or its equivalent is prerequisite to candidacy for the Ph.D. degree in any of the subjects of sociology. M.A. candidates at Cornell major in general sociology which covers the four specific subjects of sociology: social organization and change, research methodology, demography-ecology, and social psychology. Students entering Cornell with a Master's degree from other institutions will be required to make up any deficiencies in the subjects mentioned.

Ph.D. candidates will select their major from one of the four subjects listed below. Two minors are required, at least one of which should be chosen from fields outside the Department of Sociology.

Social Organization and Change. When offered as a major: (1) a thorough knowledge of theories of social organization and social change; (2) a working knowledge of research methods; (3) a detailed knowledge of two subfields in social organization such as the following: formal organization and bureaucracy, the family, ethnic relations, political sociology, social stratification, public opinion, sociology of religion, sociology of work.

When offered as a minor: a general knowledge of parts (1) and (2) of the above requirement and a working knowledge of one subfield.

Research Methodology. When offered as a major: (1) a detailed knowledge of the logic of science, (2) a general knowledge of research design, data collection techniques, and analytic procedure, (3) a working knowledge of sociological theory, (4) a concentration of study in one of the areas listed in (1) and (2).

When offered as a minor, Requirements (1), (2) and (3).

Demography-Ecology. When offered as a major: (1) a thorough knowledge of demographic and ecological theory and substantive research; (2) a thorough knowledge of the techniques of demographic and ecological data collection and analysis; (3) a working knowledge of the theory and methods of social organization and change.

When offered as a minor, a general knowledge of the topics specified in (1) and (2) above.

Social Psychology. When offered as a major: (1) a thorough knowledge of social psychological theory and research, with emphasis upon current developments; (2) a working knowledge of the methodology of social psychological research; (3) a working knowledge of psychology, sociology, and relevant aspects of other related disciplines; and (4) detailed knowledge of some specialized aspect of social psychology to be selected by the student.

When offered as a minor, a general knowledge of parts (1) and (2) of the above requirements, as well as a working knowledge of whichever aspects of social psychology are relevant to the Ph.D. dissertation topic.

The prospective student is advised to consult the following catalogs for information about instruction and research in sociology: 1) *Announcement of the College of Arts and Sciences,* Departments of Anthropology, Asian Studies, Latin American Program, Psychology, and Sociology, 2) *Announcement of the College of Agriculture,* Department of Rural Sociology, 3) *Announcement of the College of Home Economics,* Department of Child Development and Family Relationships, 4) *Announcement of the School of Industrial and Labor Relations,* 5) *Announcement of the Graduate School of Business and Public Administration.* A comprehensive brochure, *Sociology at Cornell,* can be obtained by writing to: Sociology Field Representative, Morrill Hall, Ithaca, New York.

STATISTICS *(AG., ARTS, ENGIN., I.L.R.)*

Faculty: I. Blumen, R. Bechhofer, R. Farrell, W. T. Federer, J. Kiefer, P. J. McCarthy, P. Ney, D. S. Robson, L. Weiss.

APPROVED MAJOR SUBJECT

Statistics 1, 2

Language requirement for Master's degree: proficiency in French, German, or Russian or an approved substitute before completion of the second residence unit.

The aim of graduate work in statistics is the training of individuals who will (1) have a thorough knowledge of the theoretical basis of modern statistical method and have demonstrated ability to make significant contributions to this theory, (2) have developed an understanding of the methods of scientific research in general and the role which statistics plays in this research, and (3) have had experience in aiding workers in various fields in the application of statistical method. For this reason, the minor subject or subjects must be taken with individuals outside the field, and one minor will ordinarily be in the Field of Mathematics. Students preparing for graduate work in statistics are urged to obtain a thorough grounding in mathematics through advanced calculus since their programs of study will be seriously delayed if this preparation is lacking. If their interest is primarily in mathematical statistics, they should consult the section on the Field of Mathematics in this Announcement.

A student majoring in statistics must complete a graduate sequence of courses in mathematical statistics (offered in the Department of Mathematics) which has been approved by his committee. Other course work required of majors in statistics will be chosen from among offerings by the above listed members of the field in the Department of Plant Breeding *(Ag.)* and the Schools of Mechanical Engineering *(Engin.)* and Industrial and Labor Relations *(I.L.R.)*. Provisions for minoring in statistics are given in the sections of this Announcement devoted to the Fields of Industrial and Labor Relations, Mathematics, Mechanical Engineering, and Plant Breeding. A brochure on statistics may be obtained by writing to the Cornell Statistics Center, Ives Hall.

TEXTILES AND CLOTHING *(H.E.)*

Faculty: C. Baumgartner, M. Humphrey, E. F. McMurry, M. S. Ryan, F. M. Spratt, E. E. Stout, M. V. White.

APPROVED MAJOR AND MINOR SUBJECTS

Textiles 2, 3, 4 Clothing 2, 3, 4
Textiles and Clothing 2, 3, 4

For students who wish to major or minor in the Field of Textiles and Clothing, a variety of offerings is available both as to course work and opportunities for independent study. No fixed curriculum is prescribed for majors or minors in the field. Each student's program is planned with and for her individually after consideration of her previous training, her present interests, and her plans for the future. She is encouraged to make use of the wide opportunities for study in other fields and other colleges on campus as well as in this field. Deficiency in background courses is not necessarily a bar to admission, but it may increase the time needed to earn a degree.

Candidates for a Master's degree in the Field of Textiles and Clothing are expected to have or to acquire a general knowledge of all phases of the field and an understanding of research methods in textiles and clothing, and to concentrate in any one of the various branches of textiles and clothing.

Such facilities as a conditioning room, textile equipment, and a large collection of historical costumes are available for research. For further information concerning facilities, write to the Field Representative.

On-going research in textiles and psychology of clothing allows for student participation.

Students working toward a Doctor of Philosophy degree in allied fields may minor in textiles and clothing.

A limited number of teaching and research assistantships are available in the department.

WATER RESOURCES *(AG., ARTS, ENGIN.)*

(See p. 99.)

BIOLOGICAL SCIENCES *

AGRONOMY *(AG.)*

Faculty: M. Alexander, W. A. Allaway, A. J. Baur, D. R. Bouldin, N. C. Brady, M. G. Cline, J. E. Dawson, B. E. Dethier, S. N. Fertig, R. Feuer, G. R. Free, W. L. Griffeth, H. B. Hartwig, J. F. Hodgson, W. K. Kennedy, H. A. Kerr, E. J. Kinbacher, R. E. Krenzin, J. Kubota, D. J. Lathwell, E. R. Lemon, R. F. Lucy, H. A. MacDonald, R. D. Miller, R. B. Musgrave, T. R. Nielsen, M. G. Peech, T. W. Scott, R. R. Seany, E. L. Stone, M. J. Wright, P. J. Zwerman.

APPROVED MAJOR AND MINOR SUBJECTS

Soils 1, 2, 3, 4
Field Crop Production 1, 2, 3, 4
Meteorology 1, 2, 3, 4

SPECIAL INTERESTS OF THE FACULTY

Soils:

1. Soil chemistry: Professors Peech, Dawson, Nielsen, and Hodgson
2. Soil physics: Professors Miller and Lemon
3. Soil microbiology: Professor Alexander
4. Soil fertility: Professors Brady, Lathwell, Bouldin, and Allaway
5. Soil morphology, genesis, and cartography; Professors Cline, Baur, Feuer, and Kubota
6. Soil conservation: Professors Zwerman, Free, and Kerr
7. Forest soils: Professor Stone
8. Organic soils: Professor Dawson

Field Crop Production:

1. Forage crop production, management, and utilization: Professors Hartwig, MacDonald, Kennedy, Griffeth, Seaney, and Lucy
2. Cereal crops and crop ecology: Professors Musgrave, Kinbacher, and Krenzin
3. Weed control: Professor Fertig

Meteorology:

1. Agricultural meteorology and climatology: Professor Dethier
2. Micrometeorology and microclimatology: Professor Dethier

Prospective students are urged to correspond with the professor in the above lists whose interests are nearest their own a few months in advance of the time they expect to enter.

POLICIES PECULIAR TO THE FIELD

Students preparing for graduate work in agronomy are urged to obtain a thorough knowledge of general physics, mathematics through calculus, analytical, organic, and physical chemistry, general botany, bacteriology, genetics, plant physiology, and geology. Opportunity will be afforded for further study of some of these subjects after entering the Graduate School, but a student deficient in two or more of these foundation courses cannot expect to receive a degree in the minimum time required for residence. Some practical farm experience with soil and crop management problems is also desirable. Opportunity to acquire additional experience will be afforded a limited number of students majoring in the field by summer employment on departmental projects.

Students must consult the professor in charge before registering for any course numbered above 100 (see *AG.*, Agronomy).

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*Under faculty listings for several of the biological fields of instruction some professors are listed at Geneva. These professors are eligible to serve as co-members of Special Committees of graduate students in connection with the opportunities provided by the New York State Agricultural Experiment Station at Geneva (see p. 41).

ANIMAL BREEDING *(AG.)*

Faculty: R. W. Bratton, J. H. Bruckner, R. K. Cole, R. H. Foote, C. R. Henderson, F. B. Hutt, D. R. Marble.

APPROVED MAJOR AND MINOR SUBJECTS

Animal Breeding 1, 2, 4
Animal Genetics 1, 2, 4

Language requirement for the Master's degree: proficiency in French or German is required by Professors Cole and Hutt. The other professors in this field usually require one language for the Master's degree if the student expects to become a candidate for the Ph.D.

Before entering graduate study in animal breeding, the student should have had courses in mathematics, zoology, general biology, comparative anatomy, physiology, and chemistry, and elementary courses in genetics and animal breeding. Some practical experience in animal husbandry, poultry husbandry, or plant breeding is desirable.

Graduate students will be expected to take certain courses in animal physiology, biochemistry, embryology, cytology, genetics, biometry, and histology. One or more of these may be selected as a minor subject.

Graduate studies in animal breeding may be taken in several departments of the University, and the student should consult the course offering of each of these departments.

Work in genetics and breeding of large animals, including physiology of reproduction, is offered in the Department of Animal Husbandry under the supervision of Professors Bratton, Foote, and Henderson.

Graduate study in animal genetics is offered in the Department of Poultry Husbandry, where work in that field is supervised by Professors Hutt, Cole, Bruckner, and Marble.

ANIMAL HUSBANDRY *(AG.)*

Faculty: S. A. Asdell, W. F. Brannon, R. W. Bratton, H. W. Carter, J. M. Elliot, R. H. Foote, W. Hansel, C. R. Henderson, D. E. Hogue, J. K. Loosli, C. M. McCay, W. G. Merrill, J. I. Miller, E. A. Pierce, W. G. Pond, J. T. Reid, G. H. Schmidt, S. T. Slack, S. E. Smith, J. R. Stouffer, G. W. Trimberger, K. L. Turk, R. G. Warner, G. H. Wellington.

APPROVED MAJOR AND MINOR SUBJECTS

Animal Husbandry 1, 2, 3, 4
Animal Nutrition 1, 2, 3, 4
Animal Breeding 1, 2, 3, 4
Dairy Husbandry 1, 2, 3, 4

Note: If the major for the Ph.D. lies in one of these subjects, not more than one of the other three should be selected for a minor.

Although there are no foreign language requirements for the Master's degree, foreign language is recommended for those candidates who expect to go on for the Ph.D.

To enter graduate study in any of the subject matter fields in animal husbandry, the student should have the equivalent of the following courses: elementary feeds and feeding, animal breeding, and the various production courses in dairy and beef cattle, sheep, and swine. Also, the student should have basic courses in biology or zoology, bacteriology, chemistry, organic chemistry, mathematics, physics, animal physiology, and genetics.

In addition to the graduate courses in animal husbandry, candidates for the degrees of M.S. and Ph.D. will be expected to take advanced courses in chemistry, biochemistry, physiology, genetics, biological statistics, and other related fields.

ANIMAL NUTRITION *(AG.)*

Faculty: R. H. Barnes, C. L. Comar, D. E. Hogue, F. W. Lengemann, J. K. Loosli, C. M. McCay, M. C. Nesheim, W. G. Pond, J. T. Reid, M. L. Scott, S. E. Smith, R. G. Warner, R. H. Wasserman, R. J. Young.

APPROVED MAJOR AND MINOR SUBJECT

Animal Nutrition 1, 2, 4

To enter upon graduate study with animal nutrition as a major subject, the student should have preparation in general biology or zoology, mathematics, introductory chemistry, analytical chemistry, organic chemistry, physics, human or animal physiology, and animal breeding or genetics. Some preparation or experience in livestock or poultry production is desirable but not required.

In the course of preparation for an advanced degree, candidates, according to their special interests, may acquire training in nutrition, biochemistry, physiology, pathology, food technology, histology, calculus, statistics, and other fields of science and technology. Students are generally advised to select either biochemistry or physiology as minor fields of study for the Master's degree and both of these subjects as minor fields for the doctorate. However, other minor fields of study such as those listed above may be selected, depending upon the student's interest. Physical chemistry and advanced work in organic chemistry may be required of students particularly interested in the biochemistry of nutrition.

A strong research program in animal nutrition is maintained at Cornell University under the direction of members of the faculty responsible for the training of graduate students in this field. Students are frequently able to broaden their research training and experience by participating in some of the animal nutrition projects of the Experiment Station. As a research problem for the degree, students are permitted to select, if they desire, various phases of established projects which permit them to exercise originality and independence of thinking.

If they do not already possess a reading knowledge of German and French, students expecting to continue their graduate studies should prepare to meet the language requirement for the doctorate during the course of their preparation for the Master's degree.

Students in nutrition may be admitted to candidacy for the general degrees (M.S. or Ph.D.) as described above, or the professional degree, Master of Nutritional Science (M.N.S.). A listing and description of courses in the M.N.S. program are to be found in the *Announcement of the Graduate School of Nutrition.*

ANIMAL PHYSIOLOGY *(AG.)*

Faculty: J. M. Anderson, S. A. Asdell, J. Bentinck-Smith, E. N. Bergman, R. W. Bratton, C. L. Comar, T. Eisner, R. H. Foote, P. W. Gilbert, A. C. Goldstein, W. Hansel, F. W. Lengemann, S. L. Leonard, W. N. McFarland, L. L. Nangeroni, R. D. O'Brien, R. L. Patton, R. B. Reeves, G. H. Schmidt, A. F. Sellers, C. E. Stevens, A. van Tienhoven, R. H. Wasserman, W. A. Wimsatt, R. R. Zimmermann.

APPROVED MAJOR AND MINOR SUBJECT

Animal Physiology 1, 2, 3, 4

Language requirement for the Master's degree: a candidate for the M.S. degree must pass the Graduate School requirement in one foreign language. He is normally expected to do this at least before his final semester of study.

SPECIAL INTERESTS OF THE FACULTY

Behavioral physiology: Eisner, Goldstein, Zimmermann
Comparative physiology: McFarland
Comparative toxicology: O'Brien
Endocrinology: Hansel, Leonard, van Tienhoven
Gastro-intestinal physiology: Sellers, Stevens, Wasserman
General and cellular physiology: Reeves
Insect physiology: Eisner, Patton
Invertebrate physiology: Anderson
Lactation: Schmidt
Metabolism: Bergman
Pathological physiology: Bentinck-Smith
Radiation biology: Comar, Lengemann, Wasserman

Reproduction: Asdell, Bratton, Foote, Hansel, Leonard, van Tienhoven, Wimsatt
Vertebrate physiology: Gilbert, Nangeroni, Sellers, Wimsatt

A prospective student is urged to correspond with the professor in the above list whose interests are nearest his own. This should be done a few months before he expects to enter.

POLICIES GENERAL TO THE FIELD

Students preparing for work in the Field of Animal Physiology are urged to obtain a good knowledge of biology, biochemistry, and physics. Calculus, statistics, and genetics are also advisable.

A Ph.D. candidate must have at least one minor committeeman who is not a member of the animal physiology field.

BACTERIOLOGY *(AG.)*

Faculty: E. A. Delwiche, R. F. Holland, G. Knaysi, R. E. MacDonald, H. B. Naylor, H. W. Seeley, Jr., P. J. Van Demark, S. A. Zahler. *At Geneva:* G. J. Hucker, C. S. Pederson, D. F. Splittstoesser, K. H. Steinkraus.

APPROVED MAJOR AND MINOR SUBJECT

Bacteriology 1, 2, 4 (See also Pathogenic Bacteriology 1, 2, 3, 4, p. 81)

Language requirement for Master's degree: college entrance language.

Students planning graduate study in the Field of Bacteriology should have preparation in general chemistry, qualitative and quantitative analysis, organic chemistry, physics, and introductory courses in the biological sciences. In addition, training in physical chemistry and calculus is desirable. Deficiency in any of the subjects listed does not necessarily preclude admission but may increase the time necessary to earn a degree.

Well-equipped laboratories are available. Those branches of microbiological research in which the staff is experienced and especially interested include morphology and cytology, physiology and biochemistry, genetics, bacteriophagy, and systematic and applied bacteriology.

It is to be emphasized that in addition to a creditable performance in the formal program of courses leading to a broad knowledge of bacteriology and related fields, the graduate student registered for an advanced degree is expected to demonstrate ability to plan and conduct independent and original research. The successful culmination of a worthy research project is considered the most important prerequisite to the Ph.D. degree.

BIOCHEMISTRY *(AG.)*

Faculty: R. H. Barnes, T. C. Bruice, L. J. Daniel, J. L. Gaylor, M. Gibbs, G. P. Hess, R. W. Holley, D. B. McCormick, A. L. Neal, W. L. Nelson, H. A. Scheraga, F. C. Steward, J. F. Thompson, H. H. Williams, L. D. Wright, R. G. Young. *At Geneva:* D. B. Hand, Z. I. Kertesz, F. A. Lee, L. M. Massey, Jr., L. R. Mattick, R. S. Shallenberger, J. P. Van Buren.

APPROVED MAJOR AND MINOR SUBJECT

Biochemistry 1, 2, 4

A student desiring to undertake graduate work in the Field of Biochemistry should possess a sound chemistry background and a broad training in the biological and physical sciences. Opportunity will be provided by the extension of the period of graduate study for the candidate to correct minor deficiencies in the above areas. It is recommended that those entering with a strong background in chemistry should choose a biological subject as a minor, and conversely, those with a strong background in biology should choose a branch of chemistry as a minor. The program of study, including the selection of minor subjects, will be governed by the student's background, needs, and interests. By proper selection of minor subjects the student may focus his graduate study on animal or plant biochemistry but is expected to be proficient in the general field.

Candidates who choose biochemistry as a minor should have adequate training in chemistry and the biological sciences.

The laboratories at Ithaca are especially equipped for research in enzyme chemistry, intermediary metabolism, nutritional biochemistry, analytical methods, plant and animal investigations, and food biochemistry (at Ithaca and Geneva).

Several assistantships are available both at Ithaca and at Geneva each year, and applications for these should be made directly to the faculty representative.

BOTANY *(AG.)*

Faculty: H. P. Banks, D. W. Bierhorst, R. T. Clausen, S. I. Honda, J. M. Kingsbury, E. M. Shantz, F. C. Steward, J. F. Thompson, and C. H. Uhl. *At Geneva:* B. E. Clark, W. F. Crosier, J. Einset. *At the Bailey Hortorium:* W. J. Dress, W. Ingram, Jr., H. E. Moore, Jr.

APPROVED MAJOR AND MINOR SUBJECTS

General Botany 2, 4
Cytology 1, 2, 3, 4
Paleobotany 1, 2, 3, 4
Phycology 1, 2, 3, 4
Plant Morphology and Anatomy 1, 2, 3, 4
Plant Physiology 1, 2, 3, 4
Plant Taxonomy 1, 2, 3, 4

Language requirement for Master's degree: college entrance French and/or German or proficiency before completion of second residence unit.

GENERAL REQUIREMENTS FOR ALL DEGREES

An adequate knowledge of the structure, functions, and classification of plants is required of all candidates with major subjects in the Field of Botany. Candidates also should have basic training in chemistry, physics, geology, and mathematics.

REQUIREMENTS FOR MAJOR SUBJECTS

Additional basic requirements for the major subjects are as follows:

General Botany. Additional requirements will be determined in each individual case.

Cytology and Cytogenetics. An adequate knowledge of cytology and two of the following: genetics or plant breeding, plant morphology and anatomy, plant physiology, or plant taxonomy. Professor Uhl.

Paleobotany. Additional training in plant morphology and anatomy, and adequate knowledge of paleobotany and general stratigraphic geology. Professor Banks.

Phycology. An adequate knowledge of morphology and taxonomy. Additional training in cryptogamic botany and physiology. Professor Kingsbury.

Plant Morphology and Anatomy. Additional training in plant morphology and anatomy and plant taxonomy, and adequate knowledge of cytology, genetics, or paleobotany. Professors Bierhorst and Banks.

Plant Physiology. Additional training in plant physiology, and adequate knowledge of chemistry, a general knowledge of mathematics and physics, and training in bacteriology, genetics, mycology, plant pathology, or soils. Professors Steward, Thompson, Shantz, and Honda.

Plant Taxonomy. Additional training in plant taxonomy and ecology and an adequate knowledge of genetics and statistics. Professor Clausen.

Opportunity for graduate research in plant taxonomy, with similar requirements, is also available to a limited number of graduate students at the Bailey Hortorium. Research programs at the Hortorium deal primarily with cultivated plants but are necessarily based on studies of wild plant populations. Professors Dress, Ingram, and Moore.

For Summer Research grants and assistantships in botany at the Museum of Northern Arizona, consult with the Field Representative.

CONSERVATION *(AG.)*

Faculty: J. P. Barlow, C. O. Berg, W. C. Dilger, W. R. Eadie, A. W. Eipper, L. S. Hamilton, O. H. Hewitt, P. P. Kellogg, R. R. Morrow, A. M. Phillips, Jr., E. C. Raney, C. G. Sibley, G. A. Swanson, D. A. Webster.

APPROVED MAJOR AND MINOR SUBJECTS

Fishery Biology 1, 2, 3, 4
Forest Conservation 3, 4
Natural Resources Conservation 1, 2, 3, 4
Oceanography 1, 2, 3, 4
Vertebrate Zoology 1, 2, 3, 4 (including herpetology, ichthyology, mammalogy, ornithology, and comparative vertebrate ethology).
Wildlife Management 1, 2, 3, 4

Language requirement for the Master's degree: college entrance foreign language or six hours of college language.

A doctoral student majoring in the Field of Conservation should choose at least one of his minor subjects from some other field. A written prequalifying examination is given during the first week of the fall term to all doctoral candidates.

To undertake study in the biological subjects the student should be well prepared in biological sciences and should have or must acquire a foundation in the specialized field of study which he intends to pursue. A strong background in the other biological and physical sciences is highly desirable, and a working knowledge of statistical methods is important in all fields. To undertake graduate study in natural resources conservation, the student must come adequately trained in an existing professional field concerned with the management of natural resources, and he must (with only rare exceptions) have professional job experience. Staff members are available to direct graduate study during the regular University Summer Session, and selected summer courses are offered.

Members of the staff will be interested in directing research in the fields as listed: J. P. Barlow, oceanography and marine ecology; W. C. Dilger, ornithology and comparative vertebrate ethology; W. R. Eadie, Mammalogy; A. W. Eipper, freshwater fisheries management; L. S. Hamilton, natural resources conservation and forest conservation; O. H. Hewitt, wildlife management; P. P. Kellogg, ornithology and biological acoustics; R. R. Morrow, forest conservation; A. M. Phillips, nutrition and physiology of fishes; E. C. Raney, ichthyology and management of anadromous and marine fisheries; C. G. Sibley, ornithology; G. A. Swanson, wildlife management and natural resources conservation; D. A. Webster, freshwater fisheries management.

Attention is also directed to the fields of study and courses offered in the Fields of Botany *(Ag.)*, Zoology *(Arts)*, Entomology and Limnology *(Ag.)*, and Water Resources *(Ag., Arts, Engin.)*. Graduate study in conservation education is directed under the Nature, Science, and Conservation Education Program *(Ed.)*

DAIRY SCIENCE *(AG.)*

Faculty: B. L. Herrington, R. F. Holland, W. K. Jordan, F. V. Kosikowski, V. N. Krukovsky, R. P. March, H. B. Naylor, W. F. Shipe, Jr., J. C. White.

APPROVED MAJOR AND MINOR SUBJECTS

Dairy Science 1, 2, 4
Dairy Chemistry 1, 2, 4

The research interests of the individual members of the staff are broad, but, in general, they may be indicated as follows: R. F. Holland, market milk and related products; B. L. Herrington, physico-chemical studies of milk products; W. K. Jordan, dairy engineering, ice cream, and concentrated milk products; F. V. Kosikowski, biochemistry, bacteriology, and technology of dairy products; V. N. Krukovsky, chemistry of milk and fat-containing food products; R. P. March, handling of milk on the farm and in the fluid milk plant; H. B. Naylor, dairy bacteriology; W. F. Shipe, Jr., chemical studies of dairy products; J. C. White, sanitary and technical problems of milk and milk products.

Those intending to major in dairy science should have preparation in calculus; physics; bacteriology; qualitative, quantitative, and organic chemistry; and dairy industry.

Those intending to major in dairy chemistry should offer calculus; physics; qualitative, quantitative, organic, and physical chemistry. Training in dairy industry is desirable but not

essential. Deficiency in any of the subjects listed is not necessarily a bar to admission, but it may increase the time needed to earn the degree.

In general, graduate students are expected to acquire a broad knowledge of the chemical, physical, and biological properties of milk and its products. However, mastery of the subject material and the acquisition of residence units alone are not sufficient to earn the degree. Candidates must show that they have matured as students, and that they are able to conduct independent and intensive study in the laboratory and in the library.

ENTOMOLOGY AND LIMNOLOGY *(AG.)*

Faculty: C. O. Berg, J. L. Brann, W. L. Brown, J. E. Dewey, E. J. Dyce, T. Eisner, J. G. Franclemont, G. G. Gyrisco, W. T. Keeton, D. J. Lisk, J. G. Matthysse, R. A. Morse, A. A. Muka, J. A. Naegele, R. D. O'Brien, C. E. Palm, R. L. Patton, D. Pimentel, W. A. Rawlins, M. Semel (at Riverhead), B. V. Travis, L. D. Uhler, T. C. Watkins, D. A. Webster, J. A. Weidhaas, P. H. Wooley, R. G. Young. *At Geneva:* J. A. Adams, (at Poughkeepsie), P. J. Chapman, A. C. Davis, R. W. Dean (at Poughkeepsie), F. L. Gambrel, E. H. Glass, G. E. R. Hervey, S. E. Lienk, F. L. McEwen, G. A. Schaefers, P. R. Sferra, E. H. Smith, E. F. Taschenberg (at Fredonia).

APPROVED MAJOR AND MINOR SUBJECTS

Apiculture 1, 2, 3, 4
Insect Ecology 1, 2, 3, 4
Economic Entomology 1, 2, 3, 4
Insect Morphology 1, 2, 3, 4
Insect Pathology 1, 2, 3, 4
Insect Biochemistry 1, 2, 3, 4
Insect Taxonomy 1, 2, 3, 4
Insect Physiology 1, 2, 3, 4
Insect Toxicology 1, 2, 3, 4
Insecticide Chemistry 1, 2, 3, 4
Medical Entomology 1, 2, 3, 4
Parasitology 1, 2, 3, 4
Limnology 1, 2, 3, 4
Entomology 4

Language requirement for the Master's degree: proficiency in one language.

Excellent opportunities are offered in the Field of Entomology and Limnology for graduate study in all phases of biology (ecology, morphology, physiology, biochemistry, and taxonomy), apiculture, and/or in the technology of insect control. Emphasis of study and research is on insects and related invertebrates; these are ideally suited for zoological investigations because of their numbers and ease of manipulation in laboratory and nature. The interests of the staff are broad, and they are well qualified to direct study and research in the subjects listed.

To undertake graduate study the student should be well prepared in the fundamentals of biology, physics, chemistry, and certain basic arts and must have or acquire a foundation in the field of study which he pursues. In the summer members of the staff present a limited number of selected courses during the six-week Summer School of Cornell University and are also available to direct research of graduate students.

Special facilities for study and research include the finest entomological library, an extensive insect collection, an insectary, greenhouses, field stations, and numerous well-equipped laboratories.

FLORICULTURE AND ORNAMENTAL HORTICULTURE *(AG.)*

Faculty: W. J. Boodley, J. F. Cornman, R. T. Fox, R. W. Langhans, R. E. Lee, A. M. S. Pridham, R. J. Scannell, J. G. Seeley, H. B. Tukey, Jr.

APPROVED MAJOR AND MINOR SUBJECT

Floriculture and Ornamental Horticulture: 1, 2, 4

Language requirement for Master's degree: proficiency in either French or German before completion of second residence unit, or a substitute approved by the candidate's Special Committee.

Members of the staff of this field are concerned with greenhouse crops, nursery crops, turf, plant materials, breeding of ornamental plants, and the problems of landscaping as applied to small properties.

Since many of the problems dealing with greenhouses and nursery crops, turf, and the breeding of ornamental plants are basically those of plant response with relation to the environment, it is expected that the entering graduate student will have adequate preparation in elementary horticulture, botany, plant physiology, genetics, pathology, agronomy, entomology, mathematics, chemistry, and physics. Studies relating to the physiology, propagation, nutrition, culture, and improvement of ornamental plants may be undertaken as research for an advanced degree and should be approached from the standpoint of the basic sciences. Consequently, it is appropriate to select minor subjects of study from physiology, anatomy, morphology, taxonomy, pathology, genetics, agronomy, entomology, agricultural economics, agricultural engineering, etc.

Studies involving the use of plant materials and problems of design relating to landscape service for small properties may be suitable, in which case it is expected that the student will have an adequate background in the basic principles of horticulture and plant science as well as in design and drawing. Graduate work in design and landscape service is available at the Master's level only.

Graduate students interested in problems concerned with the revision of taxonomic groups of ornamental plants are referred to the section of this Announcement describing the facilities of the L. H. Bailey Hortorium (p. 72).

FOOD AND NUTRITION *(H.E.)*

Faculty: R. H. Barnes, E. Donald, E. E. Hester, F. A. Johnston, E. J. Kuta, K. Longrée, C. M. McCay, N. Mondy, M. A. Morrison, K. J. Newman, C. J. Personius, J. Rivers, G. Steininger, C. M. Young.

APPROVED MAJOR AND MINOR SUBJECTS

Food and Nutrition 1, 2, 4
Nutrition 1, 2, 3, 4

Food 1, 2, 3, 4

A candidate who wishes to major in this Field and whose studies include preparation equivalent to that of an undergraduate major in the Department of Food and Nutrition, i.e., basic courses in food and nutrition, biochemistry, bacteriology, physics, and physiology, may begin graduate studies immediately. A student whose preparation is deficient in one or more areas may be required to register as a provisional candidate until he has made up the deficiencies.

Students with a major or minor in the Field of Food and Nutrition may select from a variety of courses, seminars, and experiences in independent study. Each student plans his program in consultation with his Special Committee, after consideration of his previous background and purpose in graduate study. Minors are selected with the candidate's professional interest in mind. For students with a major in the Field of Food and Nutrition, suggested minors in addition to those within the field include biochemistry, physiology, bacteriology, botany, statistics, anthropology, sociology, education, and other areas of home economics. General home economics may be elected for a minor at the M.S. level only. Candidates for the Ph.D. degree are expected to select at least one minor in a field of basic science related to the major.

Students in food and nutrition may be admitted to candidacy for the general degrees (M.S. or Ph.D.) as described above, or the professional degrees, Master of Nutritional Science (M.N.S.) or Master of Food Science (M.F.S.). A listing and description of courses in the M.N.S. and M.F.S. programs are to be found in the *Announcement of the Graduate School of Nutrition.*

Members of the staff who direct research studies in food are: Professors Hester, Longrée, Mondy, and Personius. Members of the staff who direct research studies in nutrition are: Professors Barnes, Donald, Johnston, Morrison, Newman, Rivers, Steininger, and Young.

Inquiries should be addressed to the Graduate Representative, Food and Nutrition, Van Rensselaer Hall, Cornell University.

FOOD SCIENCE AND TECHNOLOGY *(AG.)*

Faculty: R. C. Baker, R. H. Barnes, P. A. Buck, R. K. Finn, J. D. Hartman, B. L. Herrington, F. M. Isenberg, W. K. Jordan, F. V. Kosikowski, H. B. Naylor, J. Nowrey, O. Smith, R. M. Smock, J. R. Stouffer, G. H. Wellington. *At Geneva:* D. B. Hand, G. J. Hucker, Z. I. Kertesz, R. L. LaBelle, F. A. Lee, L. M. Massey, L. R. Mattick, J. C. Moyer, C. S. Pederson, W. B. Robinson, R. S. Shallenberger, D. F. Splittstoesser, K. H. Steinkraus, J. P. Van Buren.

APPROVED MAJOR AND MINOR SUBJECT

Food Science and Technology 1, 2, 4

Students planning graduate study in food science and technology should have preparation in one of the following: bacteriology, chemistry, or engineering. It should be noted that the members of this field are associated with many different departments of the University. Research on meats, for example, is carried on in the Department of Animal Husbandry; research on potato processing is carried on in the Department of Vegetable Crops. All course work must be taken on the Ithaca campus, but doctoral candidates may elect to conduct their research at the Experiment Station in Geneva where a new pilot plant and laboratory are available. A smaller pilot plant is located on the Ithaca campus, which supplements the research facilities of the departments specializing in raw materials.

In addition to this diversity of facilities, two separate programs are available at the Master's level. Students may be admitted to candidacy for the general degree, M.S., or for the professional degree, Master of Food Science (M.F.S.).

The M.F.S. program places less emphasis on research and more emphasis on course work. A listing and description of courses in the M.F.S. program are to be found in the *Announcement of the Graduate School of Nutrition.*

GENERAL BIOLOGY *(AG.)*

Faculty: T. Eisner, W. T. Keeton, D. Pimentel, L. D. Uhler.

APPROVED MAJOR AND MINOR SUBJECT

General Biology 2, 4

Applicants for graduate study in general biology must present scores in the Graduate Record Examination Aptitude and Advanced Biology Tests.

A Master's degree in general biology is offered for students who are graduates of small colleges, whose subject matter in the biological sciences is limited, and who plan to teach in small colleges or high schools. It is a continuation of basic subject matter courses selected to fill in gaps existing in their training. Such students are required to write a standard thesis involving a review of the literature and planned experimentation, or an essay which involves a complete review of the literature on their selected topic. These students usually work under Professor Uhler.

In addition to those in the above category, students who wish to pursue research on a problem of a basic biological nature, while at the same time devoting their course work to obtaining a needed broad background in science, may major in general biology. These students usually work under Professor Keeton or Professor Eisner. A standard research thesis is required.

Students who plan to do research in a more specific field of science may select general biology as a minor to help round out their subject-matter background.

PLANT BREEDING *(AG.)*

Faculty: R. E. Anderson, H. L. Everett, W. T. Federer, N. F. Jensen, A. A. Johnson, E. J. Kinbacher, C. C. Lowe, H. M. Munger, R. P. Murphy, R. L. Plaisted, D. S. Robson, R. R. Seaney, H. T. Stinson, A. M. Srb, B. Wallace, D. H. Wallace. *At Geneva:* J. D. Atkin, D. W. Barton, J. Einset, R. C. Lamb, G. L. Slate, R. D. Way.

APPROVED MAJOR AND MINOR SUBJECTS

Plant Breeding 1, 2, 4
Biometry 1, 2, 3, 4
Genetics 1, 2, 4

Language requirement for the Master's degree: proficiency in one language before completion of second residence unit, or substitute approved by the Field of Plant Breeding.

Students who are interested in crop improvement through breeding will register in plant breeding. Problems for research may involve studies of breeding techniques, the application of genetic principles to breeding, and the correlation of knowledge from other fields in attacks on problems such as yield, quality, adaptability, and disease and insect resistance. The depart-

ment now has active research projects with most of the important field and vegetable crops of New York, and certain materials from these projects are available for graduate student problems. For students who will register in genetics, the research problems generally will involve genic and chromosomal analyses of hereditary and evolutionary phenomena. Almost any suitable biological materials can be utilized, but the most readily available ones will be those currently being studied by the departmental staff in genetic investigations. For those students to whom problems of experimental technique and mathematical analysis of biological data hold the greater appeal, registration will be in biometry.

It is advisable that the student entering upon graduate work be well grounded in the fundamentals of the natural sciences. He should have had courses in inorganic and organic chemistry, college algebra, botany or zoology or biology, and plant, animal, or human physiology. Students intending to specialize in biological statistics will find it to their advantage to have additional training in mathematics. Broad training and experience in agriculture are essential for those planning to major in the Field of Plant Breeding.

Students majoring in plant breeding or genetics will find it necessary to remain in Ithaca during the summer, or to make satisfactory arrangements elsewhere for growing and studying the material used in connection with their research problems.

Members of the staff will be especially interested in directing research in the fields listed, although research will not be limited to these fields:

GENETICS: R. E. Anderson, radiation genetics, genetics of higher plants; H. L. Everett, genetics and cytogenetics of maize; A. M. Srb, microbial genetics, physiological genetics; H. Stinson, genetics and cytogenetics of maize and Oenothera; B. Wallace, population, evolutionary, and radiation genetics. Staff listed under plant breeding direct thesis research on the genetics of the crop plants with which they are primarily concerned. Staff listed under biometry direct theses on various aspects of statistical and mathematical genetics.

PLANT BREEDING: R. P. Murphy, C. C. Lowe, and R. E. Anderson, forage crops; N. F. Jensen and E. J. Kinbacher, small grains; R. L. Plaisted, potatoes; H. L. Everett, corn; A. A. Johnson, extension and pure seed programs; H. M. Munger and D. H. Wallace, vegetable crops; R. R. Seaney, birdsfoot trefoil.

BIOMETRY: W. T. Federer, experimental design; D. S. Robson, population genetics and quantitative inheritance. Prospective students will find it to their advantage to correspond with the staff member whose interests are most closely related to their own some months in advance of the time they wish to enter, since only a limited number of students can be accommodated.

PLANT PATHOLOGY *(AG.)*

Faculty: D. F. BATEMAN, C. W. BOOTHROYD, R. C. CETAS, R. S. DICKEY, A. W. DIMOCK, M. B. HARRISON, K. D. HICKEY, E. D. JONES, G. C. KENT, R. P. KORF, J. W. LORBEER, W. F. MAI, R. L. MILLAR, P. E. NELSON, K. G. PARKER, L. C. PETERSON, W. F. ROCHOW, A. F. ROSS, O. E. SCHULTZ, A. F. SHERF, W. A. SINCLAIR, L. J. TYLER, R. E. WILKINSON, C. E. WILLIAMSON. *At Geneva:* A. J. BRAUN, W. F. CROSIER, R. M. GILMER, J. M. HAMILTON, J. J. NATTI, D. H. PALMITER (at Poughkeepsie), W. T. SCHROEDER, M. SZKOLNIK.

APPROVED MAJOR AND MINOR SUBJECTS

(The faculty usually does not advise a minor in one of these subjects when the major is in the other.)

Plant Pathology 1, 2, 3, 4
Mycology 1, 2, 3, 4

Language requirements for Master's degree: proficiency in French, German, Russian, or approved substitute before scheduling examination for the M.S. degree.

Excellent opportunities for graduate study and research are offered in all phases of plant pathology. Students become familiar with the basic principles of disease as caused by the major groups of plant pathogens (bacteria, fungi, nematodes, and viruses). Adequate equipment and facilities are available for research under the guidance of specialists in the department. Trips to the field with staff members during the summer give students experience in diagnosing diseases and in observing up-to-date control practices. Each student is given a chance to assist with teaching in the elementary course in plant pathology and to become familiar with extension techniques. Although there are several areas of specialization within the major fields in

the department, the faculty usually does not advise a minor in one of these areas when the major is in the other. Students will receive some training in all of these areas, with opportunity to specialize in one. Applicants should be well prepared in the physical and biological sciences, *e.g.,* botany, chemistry, mathematics, and physics. Opportunity is afforded for further study in these fields, but students with deficiencies cannot expect to complete work for the degree in the minimum period of residence.

Students electing plant pathology as a specialization may work with any of several staff members in specific crop areas, *e.g.,* diseases of forage, fruit, ornamentals, potatoes, vegetables, shade trees and shrubs, small grains, and corn. Students may specialize in diseases caused by bacteria, fungi, viruses, or nematodes. Special programs of training and research are active in all these areas. In addition, special programs are available for root diseases, physiology of disease, and environmental relationships of plant diseases. New laboratories for enlarged programs in nematology, virology, physiology of disease, and root diseases have recently been completed.

Students interested in fungi will find a stimulating program of research and teaching in mycology. Programs are active in morphology, taxonomy, physiology, genetics, and cytology. Major students concentrate their research in one area. Minor problems are frequently conducted in any of these areas.

An outstanding mycological and plant pathological herbarium, unexcelled library facilities, adequate modern equipment, and cooperation with botany, biochemistry, genetics, and physics faculties enable students to follow broad research programs.

Several fellowships and scholarships are available, and there are some opportunities for postdoctoral research.

POMOLOGY *(AG.)*

Faculty: G. D. Blanpied, D. Boynton, L. J. Edgerton, M. B. Hoffman, G. H. Oberly, L. E. Powell, Jr., R. M. Smock, J. P. Tomkins. *At Geneva:* K. D. Brase, J. C. Cain, O. F. Curtis, J. Einset, C. G. Forshey, R. C. Lamb, N. J. Shaulis, G. L. Slate, R. D. Way.

APPROVED MAJOR AND MINOR SUBJECT

Pomology 1, 2, 4

Laboratory, greenhouse, orchard, and cold storage facilities at Ithaca and Geneva are available for graduate study. Special facilities for research in fruit breeding, nursery stock investigations, viticulture, and other phases of pomology are also available at Geneva.

Minor subjects may be such as plant physiology, plant anatomy, cytology, soil chemistry, soil physics, biochemistry, and chemistry. One minor in botany, particularly plant physiology, is urged.

To enter upon graduate work, the student should have the equivalent of the following courses: general botany, elementary plant physiology, economic entomology, elementary plant pathology, introductory inorganic and elementary organic chemistry, elementary pomology, and systematic pomology.

Candidates for the Master's degree should spend one summer at Ithaca or Geneva or in the field investigating their special subject. At least two summers of work are expected of candidates for the doctorate.

POULTRY HUSBANDRY *(AG.)*

Faculty: R. C. Baker, J. H. Bruckner, R. K. Cole, F. B. Hutt, D. R. Marble, M. C. Nesheim, M. L. Scott, A. van Tienhoven, R. J. Young.

APPROVED MAJOR AND MINOR SUBJECTS

Poultry Husbandry 2, 4
Animal Genetics (See p. 69.)
Animal Nutrition (See p. 69.)
Animal Physiology (See p. 70.)
Food Science and Technology (See p. 75.)

Graduate students electing a major in these fields should have had a sound training in zoology or animal biology, physiology, physics, mathematics, and chemistry. It is desirable, but not

essential that the student should have had some training and experience in poultry husbandry.

It is recommended that those candidates for the Master's degree who expect to become candidates for the doctorate study one or more foreign languages, preferably German, French, or Russian.

PSYCHOLOGY *(ARTS)*

Faculty: A. L. Baldwin, U. Bronfenbrenner, R. H. Dalton, F. S. Freeman, E. J. Gibson, J. J. Gibson, A. C. Goldstein, J. E. Hochberg, W. W. Lambert, H. S. Liddell, R. B. MacLeod, L. Meltzer, T. A. Ryan, O. W. Smith, P. C. Smith, R. R. Zimmerman.

APPROVED MAJOR AND MINOR SUBJECTS

Clinical Psychology 3
Comparative Psychology 1, 2, 3, 4
Differential Psychology and Psychological Tests 1, 2, 3, 4
Experimental Psychology 1, 2, 3, 4
Experimental Psychopathology 1, 2, 3, 4
General Psychology 2, 4
History of Psychology and Systematic Psychology 1, 2, 3, 4
Industrial Psychology 1, 2, 3, 4
Personality and Social Psychology 1, 2, 3, 4
Physiological Psychology 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French or German before the final examination.

The research laboratories of the Department of Psychology *(Arts)* are located in Morrill Hall and at the Cornell Behavior Farm. Additional research facilities are provided by the Department of Sociology and Anthropology *(Arts)*, the Department of Child Development and Family Relationships *(H.E.)*, the School of Education *(Ed)*, and the School of Industrial and Labor Relations *(I.L.R.)*. Since much of the graduate instruction and research in psychology is conducted co-operatively, the prospective student should consult the Announcements of each of these departments. A brochure containing additional information is available from the Department of Psychology, Morrill Hall.

Applicants for admission in psychology are required to submit scores for the Graduate Record Examination (Advanced Test in Psychology and Aptitude Test) and for the Miller Analogies Test.

SEED TECHNOLOGY *(AG.)*

Faculty: A. A. Johnson, J. M. Kingsbury, H. A. MacDonald, L. J. Tyler. *At Geneva:* B. E. Clark, W. F. Crosier, L. W. Nittler.

APPROVED MAJOR AND MINOR SUBJECT

Seed Technology 1, 2, 4

Language requirement for the Master's degree: college entrance foreign language.

Several departments of the New York State College of Agriculture offer courses fundamental to training in seed technology, and facilities for research in areas related to seed technology are available in departments at Ithaca and in the Department of Seed Investigations at Geneva. A student desiring training in the Field of Seed Technology may select a thesis problem in the area of his major interest. Some of the possible areas of research and faculty members with specialized knowledge in these areas are: seed improvement programs, A. A. Johnson; seed pathology, L. J. Tyler, W. F. Crosier; seed physiology, B. E. Clark; seed production, H. A. MacDonald; seed taxonomy, J. M. Kingsbury, B. E. Clark; varietal purity of seeds, A. A. Johnson, L. W. Nittler.

Correspondence with a member of the faculty listed for the area of the student's major interest is encouraged.

STATISTICS *(AG., ARTS, ENGIN., I.L.R.)*

(See p. 66.)

VEGETABLE CROPS *(AG.)*

Faculty: E. E. Ewing, J. D. Hartman, F. M. R. Isenberg, W. C. Kelly, P. A. Minges, H. M. Munger, E. B. Oyer, G. J. Raleigh, R. F. Sandsted, R. Sheldrake, O. Smith, R. D. Sweet, D. H. Wallace, W. F. Wickens. *At Geneva:* J. D. Atkin, D. W. Barton, G. A. Marx, N. H. Peck, S. Shannon, M. T. Vittum. *At Riverhead:* S. L. Dallyn, R. L. Sawyer.

APPROVED MAJOR AND MINOR SUBJECT

Vegetable Crops 1, 2, 4

Research and study in vegetable crops is the application of fundamental scientific knowledge and methods to the solution of the problems of production, handling, and processing in the vegetable industry. Types of work involved include studies of control of flowering and fruiting; development and adaptation of varieties; field plot technique; chemical weed control; the use of plant growth regulators; major and minor element fertilization, irrigation, and other soil management practices; physiological diseases; effects of cultural practices and methods of harvesting, shipping, packaging, storing and merchandising on quality; taste panel techniques; processing the potato; development and standardization of objective tests for quality. In many cases students do basic research in physiology, biochemistry, genetics, or the like in attempting to solve problems.

To enter upon graduate work in vegetable crops it is not necessary for the student to have done his undergraduate work in horticulture. More important, in some cases, is a good background in basic sciences, interest in the plant side of agriculture, and, often, farm experience. It is expected, however, that by the time he has completed his graduate training the student will have a broad knowledge of the whole Field of Vegetable Crops. Work on a vegetable crops major may also require a considerable amount of study in certain fields, such as statistics, plant physiology, or biochemistry, other than those in which the student is minoring.

The graduate program can provide training for extension or teaching careers as well as for research. Many staff members do either extension or teaching along with research, and they may be selected as members of the Special Committee. Persons now in extension, who desire to take advanced training, especially at Master's degree level, have every opportunity to select courses and thesis problems which will relate to their work. Visits to production areas and marketing centers are encouraged. Assistantships are available that provide experience in extension and in teaching as well as in research.

Students expecting to continue their graduate studies should prepare to meet the language requirement for the doctorate during the course of their preparation for the Master's degree. There is no foreign language reading requirement for the M.S.

Members of the staff will be interested in directing research in the fields as listed: Professors Kelly, Minges and Sandsted, vegetable crop physiology and production; Professors Munger, Wallace, Atkin, Barton, and Marx, breeding and genetics; Professor Sweet, chemical weed control; Professor Isenberg, postharvest physiology, biological aspects of handling and marketing vegetables; Professor Hartman, biological and food technological aspects of marketing, objective and subjective measurement of color, flavor, and texture; Professor Sheldrake, plant growing structures and methods; Professor Smith, potatoes–physiology of production and storage, factors affecting and methods of measuring cooking and processing quality; Professor Vittum, nutrition of vegetable crops, breeding; Professor Peck, mineral nutrition, fertilization and cultural practices; Professor Shannon, nutrition and inheritance studies; Professor Raleigh, mineral nutrition, muck studies, breeding; Professors Dallyn and Sawyer, potatoes–blackspot, storage, sprout inhibitors, cooking quality; other vegetables–cultural methods, fertilization, irrigation, chemical weed control; Professor Oyer, physiological aspects of vegetable production such as flowering, fruiting, and use of growth regulants; Professor Ewing, potatoes-varieties, seed value, sprout inhibitors, fertilization; Professor Wilkens, food biochemistry and technology, objective and subjective measurement of food quality.

VETERINARY MEDICINE *(VET.)*

Faculty: D. W. Baker, J. A. Baker, J. Bentinck-Smith, E. Bergman, C. I. Boyer, D. W. Bruner, B. Calnek, C. L. Comar, G. Danks, D. D. Delahanty, H. E. Evans, J. Fabricant, M. G. Fincher, F. H. Fox, E. L. Gasteiger, J. H. Gillespie, R. E. Habel, R. W. Kirk, L. P. Krook, F. W. Lengemann, E. P. Leonard, P. P. Levine, K. McEntee, L. L. Nangeroni, N. L. Norcross,

P. Olafson, M. C. Peckham, G. C. Poppensiek, C. G. Rickard, S. J. Roberts, A. F. Sellers, B. E. Sheffy, C. E. Stevens, D. N. Tapper, R. H. Wasserman, J. H. Whitlock.

APPROVED MAJOR AND MINOR SUBJECTS

Veterinary Anatomy 1, 2, 3, 4
Animal Physiology 1, 2, 3, 4
Veterinary Pathology 1, 2, 3, 4
Pathogenic Bacteriology 1, 2, 3, 4
Veterinary Virology 1, 2, 3, 4
Veterinary Pharmacology 1, 2, 3, 4
Physical Biology (including Radiation Biology) 1, 2, 3, 4
Parasitology 1, 2, 3, 4
Veterinary Medicine 1, 2, 3, 4
Veterinary Obstetrics and Diseases of the Reproductive Organs 1, 2, 3, 4
Veterinary Surgery 1, 2, 3, 4

Facilities for graduate study and research in all fields of basic and applied veterinary medicine offer many unique opportunities. In addition to the excellent University libraries, the College has a specialized collection of over 33,000 volumes and 570 current periodicals. A large and varied clinic representing all domesticated animals is available as a source of material. In addition to the animal quarters, pastures, and laboratories located on the main campus, the College operates several farms and research facilities within close proximity. These include the virus disease laboratories, poultry disease facilities, sheep and cattle disease farms, and the radiation biology laboratory.

Graduate students may work for the M.S., Ph.D., or D.Sc. in V.M. (Doctor of Science in Veterinary Medicine). The latter degree is characterized by a professional rather than a research objective (See the *Announcement of the Veterinary College* for a full description of the requirements.) A student who holds the D.V.M. degree from a recognized college in the U.S. or Canada may transfer one year's residence credit for that work toward the Ph.D. degree. In the clinical fields only candidates with the D.V.M. degree are accepted for graduate work.

Applicants for graduate study from countries other than the United States and Canada are requested to include in their credentials the results of the Graduate Record Examination (Aptitude) except in cases where this examination is not given in reasonable proximity to the student's home. Where the Graduate Record Examination is not available the student is requested to submit the results of the College Entrance Board Examination (Scholastic Aptitude Tests) in their stead.

For the Master's degree a reading knowledge of an appropriate language of scholarship (for example, German, Russian, and French or Spanish) is desirable but not required.

Anatomy: Professors Habel, Evans

The department provides facilities for graduate study in all branches of the science of anatomy as they pertain to domestic and laboratory animals and wild vertebrates. Study and research are encouraged in other fields of veterinary science and animal biology which employ morphological techniques in the determination of experimental results. Graduate students have the opportunity to gain valuable experience and stimulation by taking part in teaching activities.

The basic requirements for a major in veterinary anatomy include: (1) satisfactory completion of the professional courses in gross, microscopic, development, and neuroanatomy of the domestic animals, or equivalent formal instruction; (2) participation in the departmental seminars; (3) advanced course work selected from the offerings of the University to suit the special objectives of the student; (4) a thesis which gives evidence of a thorough review of the literature and a competent treatment of the research problem.

Physiology: Professors Sellers, Bergman, Stevens, Nangeroni

Opportunities are offered for pursuit of graduate study, toward the M.S. and Ph.D. degrees, in the areas of physiological chemistry, physiology, and pharmacology. Facilities on the Ithaca campus are used as well as medical school units of the State University of New York.

The M.S. is advised prior to the Ph.D. in the majority of instances. The minor subjects for the Masters and Ph.D. degrees are taken outside the field of the major, in other departments.

Physical Biology: Professors Comar, Wasserman, Lengemann, Tapper, Gasteiger

The Department of Physical Biology accepts Master's degree and doctoral candidates with a major in physical biology or radiation biology. Emphasis is given to the development and application of physical methods and concepts to problems of normal and abnormal metabo-

lism. Excellent facilities are available for work with laboratory and domestic animals and especially in all aspects of the use and effects of radiation. Some of the areas presently under active research include: fisson product metabolism in animals; radiation effects with emphasis on central nervous system response; biomedical dosimetry; mineral metabolism; use of radioisotopes in biological research and in clinical diagnosis; problems of radioactive contamination of the food chain.

Candidates are expected to have a strong background in biological sciences and either have had or be in a position to take during their first year the equivalent of the following courses: elementary physical chemistry, elementary physics, biometry, and calculus.

It is recommended that those candidates for the Master's degree who expect to become candidates for the doctorate study one or more foreign languages.

PATHOLOGY AND BACTERIOLOGY: Professors Olafson, Poppensiek, D. Baker, J. Baker, Bruner, Rickard, Whitlock, McEntee, Gillespie, Bentinck-Smith, Krook, Sheffy, Norcross

The laboratories of the department are well equipped with modern apparatus providing opportunity for advanced work, for those students who are properly prepared, in pathological anatomy, autopsy work, pathogenic bacteriology, immunity, immuno-chemistry, virology, and parasitology. The department operates a diagnostic laboratory for general diagnostic work, to which a great deal of pathological material and many blood samples for serological testing come from all parts of the state. This laboratory furnishes an abundance of fresh materials for teaching work and for research in animal diseases. The clinics and the routine autopsies also furnish material. Experimental herds and flocks and facilities for experimental animals are available.

AVIAN DISEASES: Professors Levine, Fabricant, Boyer, Peckham, Calnek

Excellent facilities exist at Ithaca for research in avian diseases. On the campus a new, fully equipped building, holding 41 tight, isolation pens for poultry has been put into operation recently. A poultry disease research farm is located on Snyder Hill, about three miles from the campus. There, a disease-free breeder flock is maintained for production of fertile eggs and chickens. Many small isolation buildings are available for work with the less contagious diseases. Fully equipped laboratory facilities exist at the Veterinary College and at the research farm. Adequate material is available from the poultry disease diagnostic laboratories at the Veterinary College and from the five regional branch diagnostic laboratories, which serve the poultry industry in the state.

The Veterinary College, in cooperation with the Long Island Duck Research Cooperative, Incorporated, operates a fully equipped diagnostic and research laboratory for duck diseases at Eastport, Long Island. Living quarters at the laboratory are available for graduate students and investigators.

SMALL ANIMAL MEDICINE AND SURGERY: Professors Leonard, Kirk

Graduate students may elect to work for the M.S. degree, the Ph.D. degree, or for the D.Sc. in V.M. Special subjects of study include general and advanced canine medicine, general canine surgery, canine orthopedic surgery, and breeding diseases of small animals. Basic work in any one of these special fields will be reviewed, and advanced work will be given on an assignment basis. Minor subjects are required in one or more areas of the basic sciences.

Because of the close integration of the Small Animal Clinic with the department, it is possible for the graduate student to have access to research material for whatever project he might like to undertake. The facilities are adequate for graduate study and research through the cooperation of other departments within the College.

Only candidates with the degree of D.V.M. or its equivalent are accepted, and the language requirement for the various degrees is the same as that required in the general Field of Veterinary Medicine.

SURGERY: Professors Danks, Delahanty

To enter upon graduate work in veterinary surgery, the student must have had at least two years of surgical practice or four years of general clinical experience after having completed his professional training. The department offers excellent opportunities for grad-

uate study and research in basic and fundamental general surgery, special surgical problems as applied to the farm animals, applied anesthesiology, and applied roentgenology.

There are about 2500 surgical patients each year in the large animal hospital. In addition, there are about 100 horses, cattle, and sheep available each year for teaching and research. The physical facilities are adequate for increasing the number of experimental animals. The program is designed especially to provide training in research methods or special projects in preparation for a career in teaching or research.

MEDICINE AND OBSTETRICS: Professors Fincher, Roberts, Fox

The Department offers courses covering the general subjects of medicine and obstetrics. These courses, in conjunction with the Ambulatory Clinic, the laboratory and general clinical field activities of the New York State Mastitis Control Program, are open to graduate students. Two competent and experienced veterinarians are available to assist in mastitis studies.

The department owns two small herds of dairy cattle which can be used for research purposes in the general field of large animal diseases including bovine mastitis, diseases of reproduction, and infectious and sporadic diseases.

The patients in the Ambulatory Clinic supply a constant source of interesting research material that is studied in cooperation with several other departments in this College. This is particularly true in the fields of bacteriology, metabolic diseases, parasitology, pharmacology, and virology.

WATER RESOURCES *(AG., ARTS, ENGIN.)*

(See p. 99.)

ZOOLOGY *(ARTS)*

Faculty: H. B. ADELMANN, J. M. ANDERSON, L. C. COLE, P. W. GILBERT, S. L. LEONARD, W. N. MCFARLAND, H. F. PARKS, R. B. REEVES, J. R. VALLENTYNE, W. A. WIMSATT.

APPROVED MAJOR AND MINOR SUBJECTS

Animal Cytology 1
Biogeochemistry 1, 2, 3, 4
Comparative and Functional Anatomy 1, 2, 3, 4
Comparative and Cellular Physiology 1, 2, 3, 4
Comparative Neurology 1, 2, 3, 4
Ecology 1, 2, 3, 4
Endocrinology 1, 2, 3, 4
Histology and Embryology 1, 2, 3, 4
Invertebrate Zoology 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in German or French, to be established before the completion of the second residence unit.

The Field of Zoology offers excellent opportunities for graduate study and research in all phases of zoology, but particularly in the descriptive and experimental aspects of the following special subjects: (1) comparative and human anatomy, with emphasis on the functional approach, (2) comparative and cellular physiology, (3) general ecology, (4) endocrinology, (5) histology and embryology, (6) invertebrate zoology, (7) comparative and general neurology, (8) limnology and biogeochemistry, and (9) biological ultrastructure. Members of the staff are especially qualified to direct research in the subjects listed, but research need not be limited to these subjects. The research interests of the members of the staff are broad; in general, they may be summarized as follows: H. B. Adelmann, experimental embryology and the history of embryology; J. M. Anderson, general and comparative anatomy of invertebrates, with emphasis on the functional histology and histochemistry of organ systems; L. C. Cole, general ecology with special emphasis on population phenomena and the mathematical theory of populations; P. W. Gilbert, vertebrate functional anatomy, i.e., correlation of habits and activities of vertebrates with their morphology, biology of elasmobranch fishes with special emphasis on reproductive patterns and sense organs; S. L. Leonard, general endocrinology with special emphasis on the anatomical, physiological, and biochemical aspects of the mechanisms of hormone action, reproduction, growth, and metabolism; W. N. McFarland, comparative physiology, osmotic and ionic regulation, respiration with special emphasis on its relationship to environmental control, and the physiology of fishes; H. F. Parks, descriptive and experimental aspects

of animal cytology, chiefly at the electron-microscopic level; R. B. Reeves, cellular physiology and biochemistry, with special emphasis on mechanisms of metabolic control in cells performing contractile, secretory, and synthetic work; J. R. Vallentyne, limnology, biogeochemistry of organic matter, and the origin of life; W. A. Wimsatt, histology, histophysiological and histochemical approach to problems of reproduction, comparative placentation, and hibernation.

Applicants for admission to graduate study in zoology must submit scores in the Graduate Record Examination Aptitude and Advanced Biology Tests.

All applicants should have completed the equivalent of a well-rounded college major in zoology, and should have some foundation in the particular phase of zoology they desire to pursue. Courses in organic chemistry and elementary physics should also have been completed. Although an exceptional student may be admitted without having finished one or more of these requirements, he should then expect to remain in residence beyond the minimum period to make up the deficiencies.

In addition to the courses offered by the Department of Zoology *(Arts)*, other courses of study that are often valuable to graduate students (either as individual courses or as minor subjects) are: chemistry (especially organic and physical chemistry), geology, mathematics, psychology, and physics *(Arts)*: bacteriology, biochemistry, botany, conservation, entomology, genetics (Department of Plant Breeding), and physiology of reproduction (Department of Animal Husbandry) *(Ag.)*; and physiology and physical biology *(Vet.)*.

For summer research grants and assistantships in zoology at the Museum of Northern Arizona consult with the Field Representative.

PHYSICAL SCIENCES

AEROSPACE ENGINEERING *(ENGIN.)*

Faculty: E. L. Resler, Jr., W. R. Sears, S. F. Shen, D. L. Turcotte.

APPROVED MAJOR AND MINOR SUBJECTS

Aerospace Engineering 1, 3, 4 Aerodynamics 4

In this field of graduate study emphasis is placed on the aerospace sciences rather than mere proficiency in present-day techniques. Consequently, graduate students having aerospace engineering as their major subject will be urged to select as their minor subjects the basic sciences, such as mathematics, physics, and mechanics.

Much of the research carried out in this field at Cornell is concerned with fundamental problems in the dynamics of fluids. Whenever possible, these investigations combine the techniques of theory and laboratory experiment, making use of the experimental facilities of the Graduate School of Aerospace Engineering, on the campus. In every investigation, an attempt is made to correlate theory with observation and practical experience.

A group working under the direction of Professor Resler is investigating the dynamics of gases at extreme temperatures. Generally speaking, their interests lie in matters in which the sciences of physics and chemistry are finding application to the aerodynamics of propulsion systems and to flight of missiles and space vehicles.

The branch of fluid mechanics called magnetohydrodynamics now forms an essential part of the School's activities; Professors Resler and Sears are engaged in this research, both in theory and in the laboratory. This interest brings the School into close contact with several other departments of the University where magnetohydrodynamics is being studied. Professor Shen and his students are pursuing investigations in the area of rarefied-gas dynamics, which is closely related to the other aspects of real-gas dynamics and air chemistry mentioned above. The School also maintains active interest and research in subjects basic to modern wing and propulsion-system design, such as boundary-layer theory and hypersonic aerodynamics. Professor Turcotte's interests include problems of missile dynamics, trajectories, and orbits, besides subjects already mentioned.

Research in aeronautical structures is not carried out in this School but is a major concern of the Field of Engineering Mechanics, where it is directed by Professors P. P. Bijlaard, H. D. Conway, Y. H. Pao, and their associates.

Candidates for the Ph.D. with a major in this field who do not already hold the Master's degree will be encouraged to matriculate first as candidates for the professional degree,

M.Aero.E., under the jurisdiction of the Graduate School of Aerospace Engineering. Information concerning this School and the degree M.Aero.E. will be found in the *Announcement of Engineering Courses and Curricula.*

AGRICULTURAL ENGINEERING *(AG.)*

Faculty: R. D. Black, L. L. Boyd, E. W. Foss, O. C. French, R. B. Furry, R. W. Guest, W. W. Gunkel, F. G. Lechner, G. Levine, R. T. Lorenzen, D. C. Ludington, E. D. Markwardt, W. F. Millier, G. E. Rehkugler, E. S. Shepardson, J. W. Spencer, C. N. Turner.

APPROVED MAJOR AND MINOR SUBJECTS

Agricultural Engineering 1, 2, 3,* 4
Agricultural Structures 1, 3,* 4
Electric Power and Processing 1, 3,* 4
Power and Machinery 1, 3,* 4
Soil and Water Engineering 1, 3,* 4

An applicant for admission as a candidate for an advanced degree in this field must hold a Bachelor's degree with specialization in agricultural engineering or its equivalent. In addition, he should have a scholarship ranking in at least the upper 40 per cent of his class. A general knowledge of agriculture also is essential.

A thesis based on a research effort is required. The candidate has considerable freedom in choosing a thesis project. Minor work usually is taken in the engineering, agricultural, or basic sciences, depending upon the student's interests and needs, but may be taken in any area. Students majoring in other fields are invited to minor in one of the approved subjects in agricultural engineering. Specific courses are listed in the *Announcements of the Colleges of Engineering, of Agriculture, and of Arts and Sciences.*

ASTRONOMY AND SPACE SCIENCES *(ARTS AND ENGINEERING)*

Faculty: R. Bolgiano, H. G. Booker, M. H. Cohen, J. P. Cox, T. R. Cuykendall, T. Gold, W. E. Gordon, K. I. Greisen, M. Harwit, M. R. Kundu, P. Morrison, B. Nichols, E. L. Resler, H. S. Sack, E. E. Salpeter, W. R. Sears, R. W. Shaw, P. Weaver.

APPROVED MAJOR AND MINOR SUBJECTS

Astronomy 1, 2, 3, 4
Astrophysics 1, 2, 3, 4
Space Sciences (general) 2, 4
Magnetohydrodynamics 1, 2, 3, 4
Radiophysics 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French, German, or Russian is desirable. Students taking astronomy or astrophysics as a major subject will be required to pass the proficiency test in one of these languages before the end of the third calendar-term of residence.

The major and both minor subjects for the doctorate should not all be chosen in this field. Students may come to this field with a strong background in astronomy, physics, mathematics, electrical engineering, or engineering physics.

Members of the staff are particularly interested in directing graduate research in the following subjects:

Astronomy and Astrophysics. Theory of stellar structure, stellar evolution, nuclear processes in stars, stellar statistics; cosmology; dynamics of the interstellar gas; solar system magnetohydrodynamics; geodetic astronomy; stellar spectroscopy; lunar photometry.

Radio Astronomy. Solar radio observations; radar studies of the moon and planets; distribution and classification of radio sources.

Atmospheric and Ionospheric Radio Investigations. Theory and observation of propagation of radio waves in ionized media such as the ionosphere; incoherent electron scattering; study of refraction, scattering, attenuation due to the inhomogeneous nature of the troposphere and ionosphere; dynamics of the atmosphere.

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* These are generally approved only for the Ph.D. and not for the M.S. if the major is in one of the above fields.

SPACE VEHICLE INSTRUMENTATION. Tenuous gas and particle flux measurements; magnetic field measurements; instrumentation relating to lunar exploration.

Graduate students in this field may be connected with the Cornell University Center for Radiophysics and Space Research. Many members of the faculty listed above are members of this Center, which possesses or is planning important facilities for geophysical and solar system investigations both by radio methods and by space vehicle instrumentation. Further details of this organization and facilities can be obtained by writing to the secretary, Cornell University Center for Radiophysics and Space Research, Phillips Hall.

CHEMICAL ENGINEERING *(ENGIN.)*

Faculty: R. K. FINN, P. HARRIOTT, J. E. HEDRICK, C. W. MASON, F. RODRIGUEZ, G. F. SCHEELE, J. C. SMITH, R. G. THORPE, R. L. VON BERG, H. F. WIEGANDT, C. C. WINDING, R. YORK.

APPROVED MAJOR AND MINOR SUBJECTS

Chemical Engineering, General 1, 2, 3, 4
Nuclear Process Engineering 1, 3
Chemical Processes and Process Control 1, 3, 4
Materials Engineering 1, 3, 4
Biochemical Engineering 1, 3

To qualify for admission, a student must have completed satisfactorily the equivalent of the fundamental work required by an accredited curriculum in chemical engineering. Outstanding students who have received a baccalaureate degree with a major in chemistry will also be considered for admission. Normally an extra year of residence is required of such students to make up work in engineering fundamentals.

Candidates for either the Master's or the Doctor's degree must choose one minor outside the field. Candidates for the Doctor's degree select the other minor and the major from approved subjects within the field. Minor subjects may be chosen in many other fields, for example, in the other Fields of Engineering, or in the Fields of Chemistry, Physics, Mathematics, Business and Public Administration, or Industrial and Labor Relations.

Candidates are expected to pursue a course of study and research that will give them a deeper comprehension of the basic and applied sciences and will develop initiative, originality, and creative ability. In order to achieve this goal the student participates in graduate courses and seminars and must complete an original, individual investigation for a thesis. Theses may involve either experimental research or special projects in such fields as design, economics, and mathematical analysis. Specific programs are planned to fit the objectives of the student and to develop original thinking. An arbitrarily fixed series of courses is not required, but each student is expected to acquire a strong background in rate and mass transfer processes, chemical processes, thermodynamics, reaction kinetics, and applied mathematics.

Graduate courses are offered in rate and mass transfer processes, thermodynamics, reaction kinetics, economics, process control, biochemical engineering, nuclear engineering, materials, and the chemistry and technology of rubbers and plastics. Research work for a thesis may be in any of these same areas.

CHEMISTRY *(ARTS)*

Faculty: A. C. ALBRECHT, S. H. BAUER, A. T. BLOMQUIST, T. C. BRUICE, W. D. COOKE, D. G. FARNUM, R. C. FAY, D. H. GESKE, M. J. GOLDSTEIN, J. L. HOARD, J. R. JOHNSON, A. W. LAUBENGAYER, J. E. LIND, F. A. LONG, J. MEINWALD, W. T. MILLER, G. H. MORRISON, R. A. PLANE, R. F. PORTER, L. T. REYNOLDS, H. A. SCHERAGA, M. J. SIENKO, B. WIDOM, C. F. WILCOX, B. WUNDERLICH, J. J. ZUCKERMAN.

APPROVED MAJOR AND MINOR SUBJECTS

Inorganic Chemistry 1, 2, 3, 4
Analytical Chemistry 1, 2, 3, 4
Organic Chemistry 1, 2, 3, 4
Physical Chemistry 1, 2, 3, 4
Theoretical Chemistry 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French or German or an approved substitute to be demonstrated upon admission; if satisfaction of the language requirement is delayed, an additional semester of residence is required.

The program of graduate study in chemistry is designed to give a broad training in the fundamental knowledge of chemistry and in methods of research. A graduate student will ordinarily pursue these objectives by taking advanced courses, by participation in organized and informal seminars and discussions with his associates and faculty members, and by carrying out and reporting on a research project in his major subject. Special opportunities are provided by (1) the Materials Science Center at Cornell which supports several research assistantships for graduate students in chemistry, and (2) a National Institutes of Health Training Grant which similarly provides trainee stipends for work in molecular biophysics within the Department of Chemistry. Upon completion of their study program, graduates normally go out to positions in research laboratories or to positions involving teaching and research.

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy with major in chemistry will be expected to offer for admission the equivalent of an A.B. degree with a major in chemistry. Such training should include courses in general chemistry, qualitative and quantitative analysis, organic chemistry, physical chemistry, and mathematics and physics. Some experience with foreign languages, preferably German and either French or Russian, is also regarded as essential. In admitting students, emphasis is placed on quality of performance and promise for research as judged by those best acquainted with applicants. Unusually promising students may be admitted with deficiencies in undergraduate training. In such cases work designed to make up the deficiencies will be required, and more than the usual period of residence may be necessary.

Proficiency tests will be required of all entering candidates for advanced degrees (M.S. or Ph.D.) with a major in chemistry. These tests are given a few days before registration for the fall term and cover the divisions of inorganic, analytical, organic, and physical chemistry. Each test will be about two and one-half hours in length and will cover material normally presented in elementary courses in the subjects listed above. The results of these tests will be used to aid the student's Special Committee in the planning of his program of study. While the results will not be considered in the usual sense of "passing" or "failing," low marks in one or more of the tests may require a preponderance of elementary courses during a term.

Graduate students are encouraged to carry on research during part of the summers, and a number of Summer Research fellowships are available for this purpose.

Graduate students are required to register with the Department of Chemistry on the registration days at the beginning of each term. Entering students will consult with the chairman of the departmental Graduate Scholarship Committee at this time.

In addition to the courses in chemistry *(Arts)*, attention is directed to courses in physics and mathematics *(Arts)*, chemical engineering, including chemical microscopy *(Engin.)*, and to work in biochemistry offered in the College of Agriculture.

A graduate student who desires to take a minor subject in chemistry with a major subject from some field other than chemistry will be required to offer or acquire a satisfactory background for advanced work. This will ordinarily consist of an introductory course in general chemistry and of intermediate courses prerequisite to advanced work in the minor subject in chemistry. The work in his minor subject in chemistry comprises advanced study planned with the approval of his Special Committee.

Specific inquiries from prospective graduate students are welcomed and should be addressed to the representative or to any member of the faculty. Applications for teaching or research assistantships should be addressed to the Chairman of the Department of Chemistry, Baker Laboratory.

CIVIL ENGINEERING *(ENGIN.)*

Faculty: V. C. Behn, D. J. Belcher, B. Broms, N. A. Christensen, G. P. Fisher, C. D. Gates, J. C. Gebhard, W. L. Hewitt, T. D. Lewis, T. Liang, G. B. Lyon, R. E. Mason, W. McGuire, A. J. McNair, A. H. Nilson, W. L. Richards, G. Winter.

APPROVED MAJOR AND MINOR SUBJECTS

Drawing and Cartography 4
Geodetic and Photogrammetric Engineering 1, 2, 3, 4
Hydraulics 1, 2, 3, 4
Hydraulic Engineering 1, 2, 3, 4
Construction Engineering and Administration 1, 2, 3, 4
Sanitary Engineering 1, 2, 3, 4
Sanitary Sciences 3, 4
Structural Engineering 1, 2, 3, 4
Soils Engineering 1, 2, 3, 4
Transportation Engineering 1, 2, 3, 4
Aerial Photographic Studies 2, 3, 4

To be admitted for graduate study in the Field of Civil Engineering, an applicant should ordinarily hold a Bachelor's degree in civil engineering from a school or college of recognized standing. However, arrangements may be made for exceptional cases when a student with undergraduate training in a different field, such as another branch of engineering, architecture, or the physical sciences, wishes to pursue graduate work in civil engineering. In such cases, additional residence may be required by the candidate's Special Committee. To be admitted the applicant must have been in at least the upper half of his class, or he must present other evidence which demonstrates his fitness to carry on graduate work.

The aim of graduate work in the studies grouped under civil engineering is not only to increase the student's proficiency in the more advanced phases of professional practice, but also to promote a deeper and broader understanding of the theoretical and empirical basis of the field, including in many cases the boundaries of present knowledge.

In addition to formal courses, individual work under personal direction by members of the staff is available.

DRAWING AND CARTOGRAPHY. The Department offers advanced drawing courses which may be adjusted to the needs of a particular student. Cartography and map reproduction are closely allied with the mapping requirements of topographers, geologists, and social scientists.

GEODETIC AND PHOTOGRAMMETRIC ENGINEERING. The Geodetic and Photogrammetric Engineering Department offers a considerable number of advanced courses in topographic engineering, geodesy, geodetic engineering, photogrammetry, map projections, theory of errors, and land surveying. Courses in related subjects with special application to surveying problems are available in other departments of the University, such as in astronomy, physics (optics and photography), mathematics, and geology *(Arts)*, in city and regional planning *(Arch.)*, and in real property *(Law)*.

HYDRAULICS AND HYDRAULIC ENGINEERING. The Department of Hydraulics and Hydraulic Engineering offers a complete sequence of advanced courses in theoretical and experimental hydraulics, covering the subjects of hydrodynamics, advanced hydraulics, flow in open channels, hydraulic measurements, hydraulic models, pumps, and turbines. Courses listed in hydraulic engineering deal with hydraulic structures, water power, rivers and harbors. Formal teaching is supplemented by informal discussions, demonstrations, laboratory experiments, and field trips. Seminars are held regularly with the participation of the staff, of graduate students, and of distinguished visitors.

In the Hydraulic Laboratory facilities are available for research and thesis work. Not infrequently, graduate students find part-time employment on laboratory projects. Graduate students may broaden their education by work in the allied subjects of structural engineering, soils engineering, mechanical engineering, aerospace engineering, agricultural engineering, mathematics, etc.

CONSTRUCTION ENGINEERING AND ADMINISTRATION. Graduate study in this area is intended to supplement the civil engineer's basic technical training with advanced studies in principles and methods of construction, management, economics, finance, and business law. These types of study are of importance in such work as municipal engineering, public administration, regional planning, city management, public housing, and valuation, as well as for the efficient and successful management of industry, construction contracting, and other lines of business with which the engineer may be connected.

SANITARY ENGINEERING. The graduate program is intended to provide a fundamental knowledge of essential scientific principles and an understanding of engineering applications, through emphasis on the theoretical and the experimental aspects of the subject. A combination of formal courses, informal study of special topics, seminars, and directed research permits flexibility to suit individual interests.

Formal instruction is offered in water supply and waste disposal systems, water and waste treatment processes, water and air quality control, the sanitary sciences, and environmental health engineering. Strong minor programs are available in systems engineering, nuclear engineering and chemical engineering; hydraulics; contributing sciences; mathematics and statistics; city and regional planning.

Specialized laboratories are available for instruction and research in sanitary chemistry, sanitary bacteriology and biology, radioactivity studies, and unit process work at the bench and pilot plant levels.

There are opportunities within the department for part-time employment in teaching and on sponsored research projects.

STRUCTURAL ENGINEERING AND SOILS ENGINEERING. The Department of Structural and Soils Engineering offers a considerable number of advanced courses in the field of structural analysis and design, and in soils and foundation engineering. In addition, courses in the fields of elasticity, stability, plasticity, applied mathematics, engineering materials, and other subjects are available in the Department of Engineering Mechanics and Materials *(Engin.)* and in the Department of Mathematics *(Arts)*. Courses on airplane structures are available in the Graduate School of Aerospace Engineering. Courses in soils engineering may be supplemented by instruction in closely allied subjects such as transportation *(Engin.)*, geology *(Arts)*, and agronomy *(Ag.)*.

Experimental facilities include a large special bay for three-dimensional facilities, full-scale testing, and testing machines up to 400,000-pound capacity with height up to 20 feet, strain gage equipment of all current types, and special laboratories for structural model analysis and soil mechanics.

The Department regularly employs graduate students for assistance in theoretical and experimental work on research projects sponsored by government and private agencies.

TRANSPORTATION ENGINEERING. The formal offerings of the department are contained in three general categories: highway and airport engineering, six courses; traffic engineering, three courses; and aerial photographic studies, two courses. The staff also offers additional instruction in various branches of aerial photographic studies, including engineering soil survey, construction planning, ground water, agricultural surveys for irrigation in arid areas, and advanced work in mineral surveys. The formal offerings in traffic engineering are supplemented both by advanced instruction within the Department and by course work in city and regional planning.

Laboratories are available for graduate study and research in bituminous materials, aggregates, soils, and other highway materials. In addition laboratory and field facilities are fully developed for aerial photographic studies and traffic engineering. Considerable emphasis is placed upon field work and practical experience. Opportunities for both are available for all phases of transportation engineering.

Students on leave from professional assignments may adjust their programs to fit their special interests and research problems.

ELECTRICAL ENGINEERING *(ENGIN.)*

Faculty: P. D. ANKRUM, R. BOLGIANO, H. G. BOOKER, N. H. BRYANT, M. COHEN, W. W. COTNER, C. L. COTTRELL, G. C. DALMAN, N. DECLARIS, L. F. EASTMAN, W. H. ERICKSON, A. S. GILMOUR, T. GOLD, W. E. GORDON, C. E. INGALLS, K. R. KLECKNER, S. LINKE, L. A. MACKENZIE, H. S. MCGAUGHAN, P. R. MCISAAC, T. MCLEAN, W. E. MESERVE, B. NICHOLS, R. E. OSBORN, J. L. ROSSON, H. G. SMITH, E. M. STRONG, R. N. SUDAN, H. C. TORNG, N. M. VRANA, L. S. WAGNER, P. F. WEAVER, G. J. WOLGA, S. W. ZIMMERMAN.

APPROVED MAJOR AND MINOR SUBJECTS

Electrical Engineering, General 1, 2, 3, 4
Communication Engineering 1, 2, 3, 4
Power Engineering 1, 2, 3, 4
Control Systems Engineering 1, 2, 3, 4
Illuminating Engineering 2, 3, 4

As prerequisite for graduate work leading to the degree of M.S. or Ph.D. with a major in the Field of Electrical Engineering the candidate should have had the equivalent of the fundamental work required by an accredited undergraduate curriculum in the area of his major subject. The candidate must also supply definite evidence of scholarly interest and aptitude for advanced study. Though the Graduate Record Examination is not required of applicants in the Field of Electrical Engineering, applicants are urged to take this examination, submitting its results along with their application for graduate work.

Considerable latitude is allowed in the selection of the minor subjects, provided that the entire program shows a unified purpose.

Adequate work in advanced physics and mathematics is required of candidates for the degree of Ph.D. It is highly recommended that at least one of the two minor subjects be chosen in the Fields of Physics or Mathematics or in other related fields outside the Field of Electrical Engineering.

The approved major and minor subjects listed above define broad areas in the Field of Electrical Engineering within which a student may plan a graduate program which best suits his needs. In addition to the formal courses listed in the *Announcement of Engineering Courses*

and Curricula members of the faculty are prepared to guide individual students in special topics and to arrange seminars for students interested in closely related lines of study and research. Proficiency is expected in all phases of the graduate program.

Members of the electrical engineering faculty are especially interested in directing graduate research in the following areas:

ELECTRICAL ENGINEERING, GENERAL: bio-medical electronics, electric network theory, electrical measurements, materials science in electrical engineering, physics of maser and laser systems, radio astronomy, ionospheric studies, satellite instrumentation, magnetohydrodynamics, plasma studies, applied mathematics.

COMMUNICATION ENGINEERING: radio wave propagation, physical and microwave electronics, information theory, communication systems, acoustics.

POWER ENGINEERING: electric power conversion, ionized gases in electromagnetic fields, electrical breakdown phenomena, magnetohydrodynamics studies, power systems analysis, electrical machinery.

CONTROL SYSTEMS ENGINEERING: feedback control systems, switching systems, analog and digital computers, industrial electronics.

ILLUMINATION ENGINEERING: light sources, illumination design, vision and color, optics.

It is not desirable, nor is it intended, that the boundaries between these areas within the Field of Electrical Engineering be too rigidly defined. Rather, every effort is made to allow each student to pursue a program designed to give him a period of broad advanced study. To this end work in such subjects as thermodynamics, fluid mechanics, engineering materials, engineering physics, biological science, or astronomy may be considered as partially fulfilling the requirements for a major or minor in electrical engineering, even though these subjects are not under the direct jurisdiction of the faculty of the School of Electrical Engineering.

ENGINEERING MECHANICS AND MATERIALS *(ENGIN.)*

Faculty: P. P. BIJLAARD, H. D. BLOCK, H. D. CONWAY, E. T. CRANCH, J. O. JEFFREY, H. H. JOHNSON, R. H. LANCE, G. S. S. LUDFORD, T. P. MITCHELL, J. R. MOYNIHAN, Y. H. PAO, A. L. RUOFF, F. O. SLATE.

APPROVED MAJOR AND MINOR SUBJECTS

Mechanics 1, 2, 3, 4
Fluid Mechanics 1, 2, 3, 4
Materials of Engineering 1, 2, 3, 4

The graduate program in applied mechanics and applied mathematics leads to the M.S. and Ph.D. degrees in engineering mechanics; in materials science it leads to the M.S. and Ph.D. degrees in engineering materials. Advanced theoretical and experimental work in these subjects gives a fundamental understanding of the newest developments in engineering and applied science. Graduate students in mechanics receive a broad training in the mechanics of particles, rigid and deformable solids, fluids and gases, and in the related fields of materials, physics, and mathematics. The analytical nature of the studies permits graduates to investigate problems that cut across varied fields of research, development, and design. Thus, they are trained for positions in academic and research institutions, as well as a wide range of industrial posts.

Research programs in mechanics include the following areas of specialization:

WAVE PROPAGATION IN SOLIDS: The dynamic response of plates, structures, machine elements, and continuous media including applications to transient loading and dynamic stress concentration.

SPACE MECHANICS: Trajectories and orbits of space vehicles and satellites, and the theory of thin-walled, light-weight structures used in space travel.

CONTINUUM THEORY: Mathematical theory of elastic and inelastic materials.

STRUCTURAL MECHANICS: The fundamentals of the statics and dynamics of structures including energy principles and buckling.

VIBRATION THEORY: Free and forced vibration of linear and nonlinear mechanical and electrical systems having lumped or continuous properties with applications to mechanical and structural design.

THEORETICAL FLUID MECHANICS: The dynamics of ideal and real fluids including the equations of motion of magnetohydrodynamics and their solution.

Engineering materials research includes both theoretical and experimental work on the mechanical properties of materials, and studies on how these properties are influenced by structure and environment. Research programs under way include stress corrosion cracking of high strength steels, initiation and propagation of fatigue cracks, the nature of the stress-strain curve of concrete, orientation in liquid metals near solidification, the basic mechanism of creep in metals, and the mechanical and electrical properties of materials subjected to high pressure. Graduate students in materials science are encouraged to acquire training in supporting areas such as physics, metallurgy, mathematics, chemistry, and mechanics. Excellent laboratory facilities are available, and the department participates in the program of the Materials Science Center.

ENGINEERING PHYSICS *(ENGIN., ARTS)*

Faculty: H. G. BOOKER, D. D. CLARK, D. R. CORSON, T. R. CUYKENDALL, D. E. FISHER, T. GOLD, P. L. HARTMAN, J. P. HOWE, M. S. NELKIN, H. F. NEWHALL, E. L. RESLER, JR., T. N. RHODIN, H. S. SACK, W. R. SEARS, B. M. SIEGEL, J. SILCOX, W. W. WEBB.

APPROVED MAJOR AND MINOR SUBJECT

Engineering Physics 1, 2, 4

Graduate study in engineering physics offers an opportunity for deepening and enlarging knowledge, and for developing research abilities in sciences basic to modern technology. It aims to provide the student with a more thorough understanding of the laws and principles which account for the behavior of nature, and to develop adequate skill in thinking analytically and in bringing to bear basic principles creatively upon problems in engineering and other applied sciences. It allows a student with an engineering background to become more proficient in physics and mathematics, and offers opportunities to a student with a physics undergraduate training to branch out into the applied sciences.

A student can choose for his thesis research any field of specialization as long as the approach to his project is compatible with the over-all objectives of the Field of Engineering Physics as stated above. The research interests of those staff members primarily concerned with the Field of Engineering Physics program are, at present, in the following areas.

SOLID STATE PHYSICS AND MATERIALS. Concerted studies of lattice imperfections (point defects, dislocations, etc.) in the bulk and of interfaces, and their relations to properties of materials, such as superconductivity, ferromagnetism, surface phenomena, structure and physical properties of thin films, electronic properties of metals and ionic crystals, diffusion, fracture, crystal growth (nucleation). Techniques used in these studies include electron microscopy, X-ray, and electron diffraction, microbalance, ultra high vacuum, mass spectrometry, internal friction, photoconductivity, ellipsometry, etc. Extensive and excellent equipment is available, specially constructed for these studies or in central facilities (light and X-ray metallography, high temperature, high pressure, crystal growth, special technical services, etc.), open to students through the affiliation of this research group with the Laboratory of Atomic and Solid State Physics and the Materials Science Center, which fosters co-operation between the different University divisions interested in materials research.

LOW ENERGY NUCLEAR PHYSICS AND NUCLEAR TECHNOLOGY. A recently completed reactor building housing a pulsed reactor (TRIGA), a zero power reactor, a subcritical assembly, a sigma pile, a gamma irradiation cell, a well equipped laboratory for nuclear instrumentation and measurements, and a 3-mev accelerator provides unique opportunities for teaching of and research in the experimental and theoretical aspects of reactor physics and other fields such as nuclear instrumentation and low energy nuclear physics. Optimization of specific types of reactors, reactor kinetics, development of counters, radiation damage, and use of activation analysis and other nuclear methods in the study of meteors are among recent research topics. The course and laboratory work on an advanced level offered by the department are recognized by the AEC for its fellowship program.

ELECTRON MICROSCOPY AND DIFFRACTION. The department (together with the Materials Science Center) maintains a very well equipped laboratory in which research is conducted in the development of instruments and techniques (electron optics, adaptation to ultra high vacuum and low temperature, thin film transmission, combination with trace techniques, etc.) as well as in applications to the life sciences, solid state physics (see above), chemistry, etc.

OTHER FIELDS

While the work just mentioned is supported by funds from or by contracts with or through the Department of Engineering Physics, a student may also avail himself of research possibilities in other departments (physics, aerospace engineering, electrical engineering, metallurgical engineering, space science, engineering mechanics and materials, etc.) through the affiliation of Department of Engineering Physics staff members with those departments. Recent graduates from the Department of Engineering Physics, profiting from this arrangement, worked in areas such as: magnetohydrodynamics, plasma physics, radio wave propagation, computer logic, semiconductor materials, etc. For these other areas and facilities available, the student is referred to the descriptions of the different departments' offerings in this Announcement.

BROCHURE

An illustrated brochure with more details about research possibilities and graduate programs in the Field of Engineering Physics is available by writing to the Field Representative, Department of Engineering Physics, Rockefeller Hall.

GEOGRAPHY

Students interested in graduate work in geography will find study programs in many aspects of this subject in several fields described in this Announcement. Graduate degrees are not offered in the subject of geography as such, but advanced study in geography is made possible by informally combining study in the constituent elements of the subject by arrangement with faculty members listed below.

Soil science	Prof. Martin G. Cline
Geology	Prof. W. Storrs Cole
Land economics	Prof. Howard E. Conklin
Climatology	Prof. Bernard E. Dethier
Rural sociology	Prof. Olaf Larson
Agricultural geography	Prof. John W. Mellor
Economics of development	Prof. Emmett Rice
Anthropology	Prof. Lauriston Sharp
Sociology	Prof. Joseph M. Stycos

Correspondence with members of the faculty in the student's special subject of interest is encouraged.

GEOLOGY AND GEOGRAPHY *(ARTS)*

Faculty: A. L. ANDERSON, A. L. BLOOM, J. D. BURFOOT, JR., W. S. COLE, G. A. KIERSCH, E. S. LENKER, J. W. WELLS.

APPROVED MAJOR AND MINOR SUBJECTS

Economic Geology 1, 2, 3, 4
Geography 1, 2, 3, 4
Geomorphology 1, 2, 3, 4
Mineralogy and Petrology 1, 2, 3, 4
Paleontology and Stratigraphy 1, 2, 3, 4
Structural Geology and Sedimentation 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French or German or an approved substitute.

Applicants for graduate study in geology must take the Graduate Record Examination Aptitude Test in sufficient time to permit consideration of the results along with the application for admission to the Graduate School.

Graduate work in geology may include investigation, under approved direction, in the field away from Ithaca. For Summer Research grants and assistantships in geology at the Museum of Northern Arizona, consult with the Field Representative.

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH *(ENGIN.)*

Faculty: J. M. Allderige, R. E. Bechhofer, R. H. Bernhard, R. W. Conway, H. P. Goode, D. L. Iglehart, J. H. K. Kao, W. L. Maxwell, P. E. Ney, M. W. Sampson, B. W. Saunders, A. Schultz, Jr., L. Weiss.

APPROVED MAJOR AND MINOR SUBJECTS

Industrial Engineering 1, 2, 3, 4
Systems Analysis and Design 1, 2, 3, 4
Engineering Administration 2, 4
Operations Research 1, 2, 4
Applied Statistics and Probability 1, 2, 3, 4
Information Processing 2, 3, 4

The following restrictions are placed on major-minor combinations when the major is in the Field of Industrial Engineering and Operations Research: (1) A minor in industrial engineering may be elected only if the major is applied statistics and probability, (2) A minor in systems analysis and design may be elected only if the major is applied statistics and probability or information processing, (3) A minor in information processing may be elected only if the major is industrial engineering, engineering administration, or applied statistics and probability.

Candidates for the Ph.D. degree must choose at least one minor outside the field. The most common choices are mathematics (Field of Mathematics), econometrics (Field of Economics), and managerial economics (Field of Business and Public Administration). The selection of a minor subject from one of the other engineering fields is also strongly encouraged.

For the professional Masters' degree, Master of Industrial Engineering (M.I.E.), see the *Announcement of Engineering Courses and Curricula.*

GENERAL REQUIREMENTS

As a prerequisite for graduate study leading to the degree of M.S. or Ph.D. with a major in the Field of Industrial Engineering and Operations Research, the candidate must have been graduated from an institution of recognized standing with a Bachelor's degree in engineering, mathematics, or the physical sciences. In addition, he must have a commendable undergraduate scholastic record and must supply other evidence of his interest in, and ability to pursue, advanced study and research in his major and minor subjects. Although the Graduate Record Examination is not required of applicants in the Field of Industrial Engineering and Operations Research, it is recommended that applicants take this examination and submit the results along with their application for graduate work.

One of the major concerns of the Field of Industrial Engineering and Operations Research is with the analysis and design of types of integrated systems involving men, machines, and materials.

Industrial Engineering. Students concentrating in industrial engineering are usually interested in studying the analysis and design of the complex operational systems that occur in industry, particularly in manufacturing. Their studies include work in the functional areas of plant design, cost analysis and control, and production planning. They are expected to achieve a high degree of facility with some of the modern analytical techniques which provide tools for rational decision-making and which aid in the establishment of valid design criteria; these techniques are drawn from such areas as inventory theory, queuing theory, mathematical programing, quality control, and computer simulation.

Operations Research and Systems Analysis and Design. Students concentrating in operations research and systems analysis and design are interested in problems which are similar to those studied by the industrial engineer. However, these problems tend to be more analytical in character, and are not restricted to those of industry. Thus the student may, for example, be concerned with air or highway traffic control systems, military operations research, or research in institutional (for example, hospital) operations; industrial problems include those associated with services, distribution, and marketing as well as manufacturing. Students who elect operations research or systems analysis and design as major subjects are usually highly oriented analytically. Their studies emphasize a broad range of problem-solving methodology of a mathematical, statistical, or computational nature. Their research may be concerned with the development of new methodology, the use of standard methodology in a new application, or a combination of these.

APPLIED STATISTICS AND PROBABILITY. The subject of applied statistics and probability should be selected by those students whose primary interests are in the methodology of statistics and probability, particularly insofar as these techniques are applied to problems arising in engineering and science. The technique areas emphasized are those associated with the statistical aspects of the design, analysis, and interpretation of engineering experiments; statistical quality control, sampling inspection, and reliability theory; statistical decision theory; applied stochastic processes (for example, queuing theory, inventory theory, and time-series analysis). Students who elect work in this subject are expected to acquire a deep knowledge of the theory underlying the various techniques; the doctoral dissertation shall represent a fundamental contribution to theory and application. All students who major in applied statistics and probability are required to minor in mathematics *(Arts)* and to include in their program courses in statistics offered by the Department of Mathematics; additional courses in statistics are found among the offerings of the Department of Plant Breeding *(Ag.)* and the School of Industrial and Labor Relations *(I.L.R.)*. Study in this subject is closely coordinated with the activities of the Cornell Statistics Center.

INFORMATION PROCESSING. The subject of information processing is concerned with the analysis and design of systems, the functions of which are to record, transmit, store, and process information. Emphasis is placed on the application and integration of equipment rather than on the design of machines. Areas of interest include systems for information retrieval, manufacturing control, or traffic control. The subject also involves such underlying theoretical topics as information theory and computing language structure. The facilities on the Ithaca campus consist of a Control Data 1604 with satellite 160-A; a Burroughs 220; an IBM 1410; and an IBM 1401. (All five are magnetic-tape oriented systems.)

ENGINEERING ADMINISTRATION. The subject of engineering administration is concerned with the problems encountered in organizing and directing engineering groups and their activities, and in the administrative practices and procedures employed.

Examples of some of the more important areas for study associated with this subject include the following: design of the engineering organization structure, liaison and communication within the organization and with related groups, engineering budgets and engineering time and cost control, information storage and retrieval, the promotion of creativity and engineering output, the engineer as supervisor, the recruitment and development of engineering personnel, and the use of technicians and other nonprofessional personnel in engineering activities.

A booklet entitled *Graduate Work in Operations Research, Industrial Engineering, Applied Statistics, and Related Areas* can be obtained by writing to the Graduate Field Representative, Industrial Engineering and Operations Research, Upson Hall, Cornell University, Ithaca, New York. The booklet contains additional information for the entering graduate student about graduate work and research in this field.

MATHEMATICS *(ARTS)*

Faculty: R. P. AGNEW, J. B. AX, I. BERSTEIN, R. A. BONIC, L. BRICKMAN, W. BROWDER, S. U. CHASE, C. R. CURJEL, R. H. FARRELL, W. FEIT, W. H. J. FUCHS, L. GROSS, A. B. HAJIAN, C. S. HERZ, R. G. HEYNEMAN, P. J. HILTON, G. A. HUNT, H. KESTEN, J. KIEFER, S. KOCHEN, G. R. LIVESAY, I. NAMIOKA, A. NERODE, P. OLUM, S. PARTER, J. J. PRICE, W. RINDLER, A. ROSENBERG, J. B. ROSSER, G. E. SACKS, F. L. SPITZER, C. J. STONE, S. WAINGER, R. J. WALKER, H. WIDOM, J. WOLFOWITZ.

APPROVED MAJOR AND MINOR SUBJECTS

Algebra 1, 2, 3, 4
Analysis 1, 2, 3, 4
Geometry 1, 2, 3, 4
Applied Mathematics 2, 3
Mathematics 1, 2, 4

Language requirements for the Master's degree: proficiency in French, German, or Russian immediately upon admission to candidacy.

Prerequisites for candidacy are a knowledge of advanced calculus (including both theoretical and applied points of view) and modern algebra.

Candidates for the Master's degree are expected to obtain some understanding of mathematical thought, ordinarily by taking about twelve hours of courses at the graduate level. Qualifications for the Doctor's degree include a broad acquaintance with the basic subjects of present-

day mathematics plus a demonstration of ability to do research in one or more branches of mathematics.

A booklet entitled *Graduate Work in Mathematics at Cornell* can be obtained by writing to the Chairman, Department of Mathematics, White Hall. The booklet contains additional information about graduate work and research in mathematics for the entering graduate student.

MECHANICAL ENGINEERING *(ENGIN.)*

Faculty: N. W. Abrahams, T. J. Baird, J. F. Booker, A. H. Burr, B. J. Conta, D. Dropkin, G. B. DuBois, F. S. Erdman, H. N. Fairchild, R. O. Fehr, B. Gebhart, R. L. Geer, G. F. Hanselman, H. J. Loberg, C. O. Mackey, H. N. McManus, F. Ocvirk, W. Pentland, R. M. Phelan, F. J. Pierce, D. G. Shepherd, R. H. Siegfried, R. L. Wehe.

APPROVED MAJOR AND MINOR SUBJECTS

Engineering Drawing 1, 2, 3, 4
Machine Design 1, 2, 3, 4
Materials Processing 1, 2, 3, 4
Thermal Processes 1, 2, 3, 4
Thermal Power 1, 2, 3, 4
Thermal Environment 1, 2, 3, 4

For the professional Masters' degrees, Master of Mechanical Engineering (M.M.E.) and Master of Industrial Engineering (M.I.E.), see the *Announcement of Engineering Courses and Curricula.*

As prerequisite for graduate study in mechanical engineering, the student should have the equivalent of the courses in his major field that are required of undergraduates in mechanical engineering at Cornell. These courses are described in the *Announcement of Engineering Courses and Curricula.* Those lacking the full equivalent of this training may be required to take one or more of these undergraduate courses or to do assigned work to make up the deficiency.

There are four departments in the Sibley School of Mechanical Engineering. Graduate work is not confined to these specific departments although major and minor subjects tend to coincide with departmental titles. Appropriate minor subjects may be taken in other divisions of the University.

Machine Design. Unique instruction is offered in design and related subjects without duplication of work offered by other departments. The thesis and related courses may be concentrated in one of the following three fields or may overlap them: (1) design and development of a machine or component, (2) theoretical analysis of machines and components, and (3) an experimental investigation to determine design data or performance. For the latter, the department has its own laboratory for stress, vibration, and endurance testing of machine parts, particularly well-equipped for studies of lubrication phenomena in journal bearings. Courses are offered on the subjects of creative design, automatic machinery, advanced design analysis, mechanical design of turbomachinery, advanced kinematics, design problems in vibration and dynamics, hydraulic and pneumatic control, automotive engineering, and experimental methods in machine design. Special interests of the staff include the lubrication and performance of bearings under high speeds and dynamic and misaligning loads, gearing, brake performance, impact stresses in machinery parts, endurance of shafts in machinery assemblies, and residual stresses. Students who major or minor in machine design usually take their other work in engineering mechanics, materials, materials processing, control systems and servo-mechanisms, mathematics, thermal engineering, or industrial engineering.

Thermal Engineering. There are excellent opportunities for both analytical and experimental studies at the graduate level in thermal engineering. The approved major and minor subjects are in three areas of special interest to the staff. In thermal processes are included such studies as advanced thermodynamics, heat transfer, thermodynamics and fluid dynamics of compressible fluid flow, and combustion. Thermal power includes advanced studies in principles of turbomachinery, combustion engines, propulsion systems, nuclear power, direct energy conversion, and solar power. Thermal environment includes advanced studies in refrigeration, air conditioning, heat pumps, and the utilization of solar energy. In the laboratories of the School of Mechanical Engineering, experimental studies may be made of thermal processes and of the performance of engineering equipment by the use of combustion engines, steam turbines, pumps, fans, compressors, steam generating units, heat exchangers, refrigerating equipment, air conditioning apparatus, and engineering instruments. By a choice of his minor subject or subjects, the

thermal engineering major may study at an advanced level in basic sciences such as mathematics, physics, and chemistry, or in related engineering fields such as aerospace engineering, chemical engineering, electrical engineering, engineering mechanics and materials, engineering physics, and metallurgical engineering. Many courses are offered at advanced level in the other departments of the School of Mechanical Engineering which may be combined to constitute a minor subject. The graduate student will ordinarily find it desirable to enroll in a number of the elective courses offered in the Department of Thermal Engineering, and he will be expected to participate in departmental seminars attended by students, staff, and visitors.

MATERIALS PROCESSING. A general survey at the advanced level will serve as the foundation for work on individual problems dealing with the principal features and specific details of machine tools, cutting tools, machinability of materials, metal cutting theory and analysis, machine tool dynamometry, cutting tool wear, thermal aspects of machining, economics of chip formation processes, new processes of metal removal, work and tool holding devices, and gaging and inspecting methods. The laboratory provides modern and unique facilities for measuring performance and efficiency of machines, tools, and accessories; testing and inspecting of equipment and parts; and experimental investigations of new methods.

ENGINEERING DRAWING. Individual attention is available to students wishing to do research and development work in industrial applications and teaching.

METALLURGICAL ENGINEERING *(ENGIN.)*

Faculty: M. S. BURTON, J. L. GREGG, C. W. MASON, J. B. NEWKIRK, T. N. RHODIN, E. SCALA, G. V. SMITH, C. W. SPENCER, H. W. WEART.

APPROVED MAJOR AND MINOR SUBJECTS

Metallurgical Engineering, General 1, 2, 4
Extractive Metallurgy 1, 3
Physical Metallurgy 1, 3

To qualify for admission to candidacy for the general degrees of Master of Science, Doctor of Philosophy with a major in metallurgical engineering, or the professional degree of Master of Metallurgical Engineering, an applicant should preferably have completed satisfactorily a course substantially equivalent in its technical content to the program leading to the degree of Bachelor of Metallurgical Engineering at Cornell. However, individuals who established superior records as undergraduate majors in chemistry, physics, chemical engineering, engineering physics, engineering science, or mechanical engineering are also encouraged to supplement their training with advanced work in metallurgy or metallurgical engineering. Such individuals possess desirable backgrounds for specialization in specific areas of metal science and engineering. They will ordinarily be required to pass without credit certain undergraduate courses, or demonstrate proficiency in the particular subject area.

Graduate study programs in metallurgical engineering at Cornell are designed to fit the needs of individual students, in the light of their previous training, aptitudes, and interests. Candidates are expected to pursue a program of study that will give them a deeper understanding of the basic and applied sciences, and that will develop initiative and originality. A candidate for a "general" degree is not required to take any fixed curriculum or a minimum number of credit hours; he can complete much of his graduate program through individually supervised work with members of the faculty. However, the student will ordinarily find it desirable to take advanced courses offered in the department and to participate in graduate seminars. He will also be urged to pursue advanced courses in mathematics, chemistry, and physics offered in the College of Arts and Sciences. A candidate for the professional degree, on the other hand, is required to complete a minimum number of credit hours, which may be exclusively curricular, i.e., without research, as described in the *Announcement of Engineering Courses and Curricula.*

A candidate for the degree of Master of Science chooses one minor field, which must be outside the Field of Metallurgical Engineering. For the degree of Doctor of Philosophy, two minors are required, one of which must be outside the field; the other may be within the Field of Metallurgical Engineering, with specialization in either physical or extractive metallurgy. Minor subjects outside the Field of Metallurgical Engineering may be chosen from a

number of areas, including chemistry, physics, mathematics, mechanics, statistics, chemical engineering, engineering physics, mechanical engineering, business administration, and industrial and labor relations.

The program of instruction and research in metallurgical engineering is an integral part of Cornell's interdisciplinary Materials Science Center.* Two of the central facilities of this Center, concerned with *metallography* and *X-ray diffraction* and with *high temperature* are housed with the metallurgical engineering division. Considerable benefit derives from the interactions of students and faculties of the different fields associated in the Center, as well as from the sharing of facilities and of course offerings.

The staff and facilities of metallurgical engineering are currently located in Olin Hall, but a new building to house metallurgical engineering, Bard Hall, is now under construction. and is expected to be ready for occupancy by February, 1963. All of the usual facilities are available, including apparatus for microscopical and X-ray diffraction examinations, a variety of furnaces for melting and heat treating, equipment for casting, working and welding, and for the study of the unit operations of extractive metallurgy, and for physical and mechanical testing. Other more specialized apparatus, such as for electron microscopy, zone refining, levitation melting, and preparation of single crystals, is also available.

Candidates for general degrees (M.S. or Ph.D.) are expected to present a thesis based on experimental research work in partial fulfillment of the requirements for the degree. Such research may be in any area of metal science and engineering or related non-metallic materials. Investigations are selected to suit the interests and needs of the students, and hence the specific projects actively in progress are constantly changing.

Current research in the department includes the following: reactions at liquid-solid interfaces; effect of crystalline imperfections upon the electrical properties of semi-conducting intermetallic compounds; effect of high pressure upon the electrical properties of semi-conductors; solidification reactions; crystal growth of anisotropic materials; recovery and recrystallization phenomena in high-purity iron alloys; solid solution strengthening of high-purity iron alloys; embrittlement of iron-base alloys containing aluminum; vacancy concentration in body-centered cubic metals; transformation kinetics of gamma phase U-Mo alloys; kinetics of graphite nucleation and growth in cast irons; substructure in metallic, semi-conductor, and ceramic crystals; structure of thin vapor-deposited metallic and nonmetallic films; X-ray diffraction microscopy; kinetics and morphology of crystal "round-off" in liquid environment; eutectoid and peritectoid transformation in binary systems other than iron-carbon.

In addition to fellowships and teaching assistantships, a number of research assistantships on either a nine-month or twelve-month basis are available.

NUCLEAR SCIENCE AND ENGINEERING *(ARTS, ENGIN.)*

Faculty: D. D. Clark, T. R. Cuykendall, D. Dropkin, D. E. Fisher, C. D. Gates, J. L. Gregg, J. P. Howe, S. Linke, W. E. Meserve, M. Nelkin, R. L. Von Berg.

APPROVED MAJOR AND MINOR SUBJECTS

Nuclear Science 1, 2
Nuclear Engineering 1, 2, 4

Graduate studies in this field are intended to increase knowledge of subjects such as those listed below and to provide training in the processes of acquiring knowledge through research.

Thesis research in nuclear science may be chosen from among the following: low energy nuclear physics and nuclear chemistry (decay schemes of radioactive nuclides, studies of the fission process, low energy nuclear reactions); neutron scattering; radiochemistry (chemistry of radioactive substances); radiation chemistry and radiation damage studies (effects of radiation on substances); nuclear cosmochemistry (nuclear phenomena in cosmological settings, such as meteorites and satellites); activation analysis (quantitative measurements by neutron-induced radioactivities); development of radiation detectors.

Thesis research in nuclear engineering is intended not only to extend knowledge but to apply it to engineering objectives. Topics may be chosen from among the following: reactor statics of slightly enriched water-moderated critical assemblies and subcritical assemblies, reactor kinetics, nuclear materials and fuels, chemo-nuclear processes, basic processes in the transfer of heat and generation of power from nuclear reactions, and selected problems in reactor design and optimization.

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* See elsewhere in this Announcement for a description of the Materials Science Center.

Research and development connected with nuclear energy requires knowledge of a number of scientific and engineering disciplines. Thus the organization of the program permits and encourages this kind of interdisciplinary study, training, and research. The above major and minor subjects will not both be used by a student because either provides adequate flexibility and breadth, and both will be strengthened by appropriate selections of other minors. Work involving nuclear phenomena, radiation, isotope production, and the like will be done for the most part in the Nuclear Reactor Laboratory which was designed specifically for this purpose. At the present time, four faculty members and all graduate students in nuclear science and engineering work in this laboratory.

The Nuclear Reactor Laboratory was occupied in 1961 and contains: (1) a TRIGA reactor which may be operated steadily at 100 kw producing a neutron flux of 1 to 5 $\times$ 10^{12}/cm^2 sec. In addition the reactor may be pulsed to a peak power of approximately 250 megawatts for the study of phenomena of fairly short duration. The width of the pulse at half maximum is approximately 40 millisec. Eight beam ports and a thermal column allow flexible use of neutrons and radiation. (2) A zero power reactor of versatile design for basic studies of reactor physics. (3) Subcritical assemblies for similar studies. (4) A shielded cell for chemo-nuclear work with up to 10,000 curie gamma sources and other radioactive materials. Accompanying laboratory space permits work with radioactive materials at low level. A 3-mev 0 to 10 milliampere Cockroft Walton accelerator for studies of radiation effects and low energy nuclear levels and reactions is planned.

Students with an undergraduate major in either science or engineering will be admitted if they show strong background in chemistry, physics, and mathematics.

PHYSICS *(ARTS)*

Faculty: V. Ambegaokar, L. L. Barnes, A. J. Bearden, K. Berkelman, H. A. Bethe, R. Bowers, B. H. Brandow, R. H. Brout, P. A. Carruthers, D. R. Corson, R. M. Cotts, T. R. Cuykendall, J. P. Delvaille, J. W. DeWire, D. A. Edwards, D. B. Fitchen, C. W. Gartlein, T. Gold, K. I. Greisen, P. L. Hartman, D. F. Holcomb, T. Kinoshita, J. A. Krumhansl, D. M. Lee, R. M. Littauer, H. Mahr, R. W. McAllister, B. D. McDaniel, P. Morrison, H. F. Newhall, J. Orear, L. G. Parratt, T. J. Peterson, R. O. Pohl, T. H. Rhodin, H. S. Sack, E. E. Salpeter, B. M. Siegel, J. Silcox, R. H. Silsbee, A. Silverman, R. L. Sproull, P. C. Stein, R. M. Talman, D. H. Tomboulian, R. R. Wilson, G. L. Wolga, W. W. Woodward.

APPROVED MAJOR AND MINOR SUBJECTS

Physics 1, 2, 3, 4
Experimental Physics 1, 2, 3, 4
Theoretical Physics 1, 2, 3, 4
Biophysics 3, 4

Language requirement for the Master's degree: proficiency in French, German, Russian, or an approved substitute, before completion of the second residence unit, or before the beginning of the third calendar-term of residence.

The major and both minor subjects for the doctorate should not be chosen inside the Field of Physics.

The major subject for the doctorate may be experimental physics only if accompanied by theoretical physics as a minor, and theoretical physics only if accompanied by experimental physics as a minor.

The major subject for the Master's degree may be physics only if the minor subject is chosen outside the Field of Physics, or for the doctorate only if both minor subjects are chosen outside the Field of Physics.

Members of the staff are especially interested in directing graduate research in the following fields:

Experimental Physics. Nuclear and particle physics; cosmic rays; X-ray physics; physical electronics; physics of solids; surface physics.

Theoretical Physics. Quantum mechanics; quantum theory of fields; theory of nuclei; fundamental particles; cosmic radiation; astrophysics; and the theory of the solid state.

A colloquium in general physics, a seminar in theoretical physics, and a seminar in solid state physics meet regularly, and seminars in special fields as arranged.

A booklet entitled *Graduate Study in Physics at Cornell* can be obtained by writing to the Chairman, Department of Physics, Rockefeller Hall. The booklet contains additional information about graduate work and research in physics for the entering graduate student.

STATISTICS *(AG., ARTS, ENGIN., I.L.R.)*

(See p. 66.)

WATER RESOURCES *(AG., ARTS, ENGIN.)*

Faculty: N. C. Brady, W. S. Cole, G. P. Fisher, C. D. Gates, L. S. Hamilton, C. Morse.

APPROVED MINOR SUBJECT

Water Resources 4

This field of study provides an integrated program of instruction, intended to turn out engineers and scientists with a comprehensive knowledge of water resource development and management, as well as depth of knowledge in their own discipline. A candidate would specialize or major in a subject in which he wished to increase his competence, while broadening his own approach to and understanding of the water resources problems of the allied disciplines. This latter objective is accomplished in part by requiring all who study in this field to select a minor subject designated as water resources.

The water resources minor would represent for each candidate a rational synthesis of formal courses, seminars, and projects outside his own discipline which, in the judgment of his committee, would be most likely to assure his achieving the comprehensive part of the dual objective stated. Courses in such areas as government, law, and public administration are available for inclusion in this minor where appropriate.

A thesis is required for all advanced degrees, and it must deal in a comprehensive way with water resources, i.e. utilize the understanding, analyses, or methodologies of several disciplines of science or engineering in the investigation.

An applicant for admission as a candidate for an advanced degree with a minor in this field must hold a Bachelor's degree in biological, physical, or social science, or in engineering. A foreign language is not required for the Master's degree. A candidate planning work at the doctoral level should recognize the importance of water resources reference material in foreign languages, and is strongly urged to prepare himself to meet the Graduate School language requirements as soon as possible.

Complementing major and minor subjects ordinarily will be chosen from the following list (faculty as shown):

Aerial Photographic Studies (Civil Engineering): D. J. Belcher, T. Liang, A. J. McNair, G. Lyon 2, 3, 4

Agricultural Policy and Economic Development (Agricultural Economics): H. Conklin, J. W. Mellor 1, 2, 3, 4

Biochemical Engineering (Chemical Engineering): R. K. Finn, C. C. Winding 1, 3

Economic Development (Economics): F. H. Golay, C. Morse, H. Malmgren 2, 3, 4

Fishery Biology (Conservation): D. A. Webster, A. W. Eipper 1, 2, 3, 4

Geography (Geology and Geography): W. S. Cole, G. A. Kiersch 1, 2, 3, 4

Hydraulics (Civil Engineering): J. A. Liggett 1, 2, 3, 4

Hydraulic Engineering (Civil Engineering): J. A. Liggett 1, 2, 3, 4

Limnology (Entomology and Limnology): C. O. Berg 1, 2, 3, 4

Meteorology (Agronomy): B. E. Dethier 1, 2, 3, 4

Natural Resources Conservation (Conservation): L. S. Hamilton, G. A. Swanson 1, 2, 3, 4

Oceanography (Conservation): J. P. Barlow 1, 2, 3, 4

Regional Planning (City and Regional Planning): B. G. Jones, K. C. Parsons, J. W. Reps 1, 3, 4

Sanitary Engineering (Civil Engineering): V. C. Behn, C. D. Gates, W. R. Lynn 1, 2, 3, 4

Soils (Agronomy): N. C. Brady, G. R. Free, H. A. Kerr, P. J. Zwerman, E. L. Stone 1, 2, 3, 4

Soil and Water Engineering (Agricultural Engineering): R. D. Black, G. Levine 1, 3, 4

Structural Geology and Sedimentation (Geology and Geography): G. A. Kiersch, W. S. Cole 1, 2, 3, 4

INDEX OF FIELDS OF INSTRUCTION AND APPROVED SUBJECTS

GENERAL INDEX